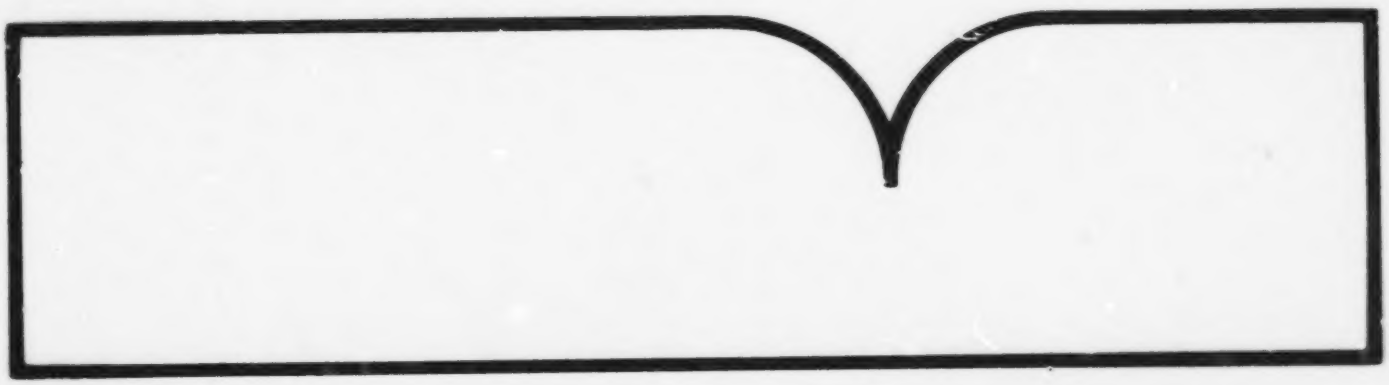
PB90-261579

Captan: Position Document 4. Intent to Cancel Registrations Conclusion of Special Review; Notice of Final Determination

(U.S.) Environmental Protection Agency, Washington, DC

24 Feb 89



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This Special Review Document addresses the risks and benefits of pesticide products containing the subject active ingredient. The Agency has determined that the use of products containing the subject active ingredient may meet or exceed a risk criterion descibed in 40 CFR Part 154. Potential hazards will be examined further to determine the nature and extent of the risk, and considering the benefits of the subject active ingredient, whether such risks cause unreasonable adverse effects on the environment.

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Part VI

Environmental Protection Agency

Captan; Intent To Cancel Registrations; Conclusion of Special Review; Notice of Final Determination

ENVIRONMENTAL PROTECTION AGENCY

[OPP-30000/34C; FRL-3528-2]

Captan; Intent To Cancel Registrations; Conclusion of Special Review

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of final determination; notice of intent to cancel registrations and deny applications for registration.

SUMMARY: This Notice annouces the conclusion of EPA's Special Review and risk/benefit analysis of captan and EPA's intent to cancel registrations and to deny registration applications for all pesticide products containing captan as an active ingredient except the following: (i) All non-food uses including technical captan; (ii) seed treatments; and (iii) the following food uses: Almonds, apples (pre- and post-harvest), apricots, blackberries, blueberries, celery (plant-bed), cherries (pre- and post-harvest), dewberries, eggplant (plant-bed), grapes, green onions, lettuce, mangoes, nectarines, peaches, pears (post-harvest only), peppers (plant-bed), pimentos (plant-bed), plums/prunes, raspberries, spinach (plant-bed), strawberries, taro and tomatoes (plant-bed).

This action concludes EPA's Special Review of captan (first announced in the Federal Register of August 18, 1980: 45 FR 54938) and is based on EPA's determination that retention of all food uses of captan products will result in unreasonable adverse effects on humans or the environment.

DATES: Requests for a hearing by a registrant, applicant, or other party adversely affected by this Notice must be received on or before March 27, 1989 or, for a registrant or applicant, within 30 days from the receipt of this Notice: whichever occurs later.

ADDRESS: Requests for a hearing must be submitted to: Hearing Clerk (A-110), Environmental Protection Agency, 401 M Street SW., Washington, DC 20460.

Information supporting this action is available for public inspection from 8 a.m. to 4 p.m., Monday through Friday, except legal holidays in the Information Services Section, Field Operations Division, (TS-767C), Office of Pesticide Programs, Environmental Protection Agency, Room 240, Crystal Mall #2, 1921 Jefferson Davis Highway, Arlington, VA 22202. Telephone: 703/557-2805.

FOR FURTHER INFORMATION CONTACT: By mail: Kathleen M. Pearce, Special Review Branch, Special Review and Reregistration Division (TS-767C), Office of Pesticide Programs, Environmental Protection Agency, 401 M Street SW., Washington, DC 20460.

Office Location and Telephone Number: Room 1006, CM #2, 1921 Jefferson Davis Highway, Arlington, VA (703) 557-7400.

SUPPLEMENTARY INFORMATION: This Notice announces EPA's decision to cancel registrations and deny applications for registrations of pesticide products containing uses of captan (N-trichloro-methylthio-4-cyclohexene-1,2-dicarboximide) as an active ingredient, which are cancelled as a result of this Notice. This Notice concludes EPA's administrative Special Review of the risks and benefits of captan which was initiated in a Federal Register Notice of August 18, 1980 (45 FR 54938). A proposed decision concerning captan was published in the Federal Register on June 21, 1985 (50 FR 25884). Supporting documents including the Technical Support Document for the PD 2/3 were made available to any requesting party at that time. EPA has evaluated the issues raised in the preliminary documents listed above in light of comments and additional data received during the Special Review process. In summary, EPA has decided to allow the continued registration of technical captan and all currently registered non-food uses including non-food agricultural uses (e.g. ornamentals) and to cancel the registration of all food uses of captan except for the following: Almonds, apples (pre- and post-harvest), apricots, blackberries, blueberries, celery (plant-bed), cherries (pre- and post-harvest), dewberries, eggplant (plant-bed), grapes, green onions, lettuce, mangoes, nectarines, peaches, pears (post-harvest only), plums/prunes, peppers (plant-bed), pimentos (plant-bed), raspberries, spinach (plant-bed), strawberries, taro and tomatoes (plant-bed), and all seed treatments.

It should be noted that the residue chemistry data required under FIFRA section 3(c)(2)(b) have not been submitted for all of the uses listed in the preceding paragraph, and that in some cases data have only been submitted in support of particular formulations or application methods. On December 7, 1988, EPA issued a Notice of Intent to Suspend all agricultural food uses (except seed treatments) for which residue data had not been received. Registrants were given 30 days to submit data or request a hearing. Due to a technical error on the part of EPA, this Notice of Intent to Suspend is being revoked. Registrants will be notified of the revocation. The Agency is considering whether to issue a new Notice of Intent to Suspend the agricultural food uses for which residue data have not been received. Therefore, although EPA, in terminating this Special Review of captan, has determined that the benefits of the use of captan on the food sites listed in the summary outweigh the risks from these uses, the use of captan on some food sites (i.e., blackberries, blueberries, celery, dewberries, eggplant, lettuce, mangoes, green onions, peppers, pimentos, raspberries, spinach, and taro) are subject to suspension for failure to provide data required to support the continued registration. EPA's actions are summarized in the following Table 1:

TABLE 1.—STATUS OF REGISTERED FOOD USES OF CAPTAN [1]

	Uses cancelled by this notice (PD 4) (C)	Uses not cancelled but subject to suspension (S)	Uses *not* cancelled and *not* subject to suspension (*)
Almonds			(*)
Apples			(*)
Apricots			(*)
Avocados	C		
Beans, Dry	C		
Beans, Succulent	C		
Beets	C		
Blackberries		S	
Blueberries		S	
Broccoli	C		
Brussels sprouts	C		

TABLE 1.—STATUS OF REGISTERED FOOD USES OF CAPTAN [1]—Continued

	Uses cancelled by this notice (PD 4) (C)	Uses not cancelled but subject to suspension (S)	Uses *not* cancelled and *not* subject to suspension (*)
Cabbage	C		
Cantaloupes	C		
Carrots	C		
Cauliflower	C		
Celery: plant-bed		S	
foliar	C		
Cherries			(*)
Collards	C		
Corn, Sweet	C		
Cotton	C		
Crabapples	C		
Cranberries	C		
Cucumbers	C		
Dewberries		S	
Eggplant: plant-bed		S	
foliar	C		
Grapefruit	C		
Grapes			(*)
Honeydew	C		
Kale	C		
Leeks	C		
Lemons	C		
Lettuce		S	
Limes	C		
Mangoes		S	
Muskmelon	C		
Mustard Greens	C		
Nectarines			(*)
Onions, Dry Bulb	C		
Onions, Green		S	
Oranges	C		
Peaches			(*)
Pears: pre-harvest	C		
post-harvest			(*)
Peas	C		
Peppers: plant bed		S	
foliar	C		
Pimentos: plant-bed		S	
foliar	C		
Pineapple	C		
Plums/Prunes			(*)
Potatoes	C		
Pumpkin	C		
Quince	C		
Raspberries		S	
Rhubarb	C		
Rutabagas	C		
Shallots	C		
Soybeans	C		
Spinach: plant-bed		S	
Squash	C		
Strawberries			(*)
Tangerines/Tangelos	C		
Taro		S	
Tomatoes: plant-bed			(*)
foliar	C		
Turnips	C		
Watermelon	C		

[1] This list attempts to identify all currently registered uses. However, due to variations in nomenclature on product labels, some uses may not be listed. The "uses not cancelled but subject to suspension (S)" and "uses not cancelled and not subject to suspension (*)" constitute the only legally registered uses once this Final Determination becomes final.

The sites which are not being cancelled but which may be subject to suspension for failure to provide required data include some minor uses (e.g., blueberries, blackberries, eggplant, peppers and pimentos). Since the benefits have been determined to outweigh the risks for these uses of captan, registration can be supported with the submission of required data. It is EPA's policy to work with the Interregional Research Program (IR–4), the pesticide industry and user groups in an effort to obtain data in support of new and existing registrations for minor uses. EPA policies implemented to facilitate minor use registrations are discussed in a Policy Statement of April 2, 1988 [51 FR 11341]. Those interested in having captan products available for the minor uses retained in this Notice but subject to suspension action under FIFRA section 3(c)(2)(B) are encouraged to pursue registration with a captan registrant. If the registrant determines that the cost of meeting the data requirements are prohibitive for these uses, it may be feasible for grower organizations or other associations to enter into a financial agreement with a

captan registrant who is prepared to collect the required data for a particular registration. Alternatively, a request may be submitted to the IR–4 Program for the development of the required data. The IR–4 Program is a nation-wide cooperative effort including EPA, the U.S. Department of Agriculture, State agricultural experiment stations and industry, which assists in the development of data (primarily residue data) for pesticide minor uses. Additional information may be obtained from the IR–4 Program, Cook College, P.O. Box 231, Rutgers University, The State University, New Brunswick, New Jersey 08903.

Other regulatory actions concerning products containing captan that are pending but are not part of the Special Review process are as follows:

(i) EPA will propose to revoke the tolerance for captan on detreated corn seed since data in support of this tolerance have not been submitted. The proposed revocation will be announced in the **Federal Register.**

(ii) A Data Call-In (DCI), issued October 26, 1988, required the submission of a 90-Day Inhalation Toxicity Study and a 90-Day Dermal Toxicity Study in rats. EPA is concerned with renal changes in male rats and local irritation of nasal passages, esophagus and forestomach in both sexes that were reported in a supplementary 90-day inhalation study submitted by industry's Captan Task Force representing the major manufacturers of captan including ICI Americas, Inc., Chevron Chemical Company, Inc., and Makhteshim-Agan (America), Inc. The data must be submitted in 10 and 15 months respectively from receipt of the DCI.

(iii) The time for submission of required residue chemistry data to support the continued use of captan for seed treatment use patterns was extended by 1 year to July 6, 1989.

(iv) Data on exposure to captan for fieldworkers and harvesters have recently been received by EPA.

The current reentry requirement (4 days) and protective clothing for field workers and harvesters will be reassessed when these data have been evaluated.

Additionally, as a result of uses being cancelled by this Notice and new residue data available to EPA, tolerance reductions or revocations will be proposed for a number of food commodities. This proposal regarding captan tolerances will be published in the **Federal Register** during 1989.

This Notice is organized into eight units. Unit I. is an introduction providing background information on captan, EPA actions prior to this Notice, and the legal basis for these actions. Unit II. summarizes the toxicological data base for captan and EPA's concerns regarding the hazard of oncogenicity. Unit III. presents EPA's assessment of dietary and non-dietary exposure to captan and their respective risks. Unit IV. gives use and benefits information on captan. Unit V. includes the comments of the Scientific Advisory Panel and the Secretary of Agriculture on the regulatory actions previously proposed by EPA in its proposed decision concerning captan issued June 21, 1985. Unit VI. describes EPA's risk/benefit assessment and final determination regarding captan and the actions required by this Notice.

Comments received from interested parties on specific risk and benefit issues are presented with EPA's response in the appropriate Units II. through VI. Unit VII. describes the procedures for implementing the actions required by this Notice, as well as the procedures for requesting a hearing. Unit VIII. lists references used in concluding this Special Review of captan.

I. Introduction

Captan is the common name for N-trichloromethylthio-4-cyclohexene-1, 2-dicarboximide. Captan acts as a broad spectrum non-systemic protectant against fungal diseases. There are approximately 320 federally registered pesticide products containing the active ingredient captan. These registrations are held by 83 registrants. The major producers/ registrants of captan formed a Captan Task Force, currently headed by ICI Americas, Inc., in order to generate toxicological and residue data to support the continued registration of selected uses of captan.

There are more than 60 registered uses for captan which is also known as Orthocide, Vancide 89, Merpan and Agrox. Captan is used as a fungicide on many food crops especially almonds, tree fruits, and small berries and as a protectant for plant seeds. There are also several non-food agricultural uses including ornamental plants and shrubs and cut flowers. Methods of application for agricultural crops include ground and aerial foliar applications, seed treatments and post harvest treatments of tree fruits. Captan formulations include dusts, wettable powders, aqueous suspensions and granules.

In the United States, usage of captan is estimated at 10 million pounds of active ingredient (a.i.) per year. About 30 percent of the total a.i. sold is used on apples and about 28 percent on seed treatments. The next largest uses are cherries, peaches and nectarines which account for about 25 percent of total a.i. sales each year.

Available estimates indicate that captan is used on 60 percent of almonds harvested in the United States, on 85 percent of sweet cherries, and approximately 50 percent of all apple acreage. Captan is used in the culture of about 20 percent of California grapes and nearly 100 percent of Florida strawberries are treated with captan. It is estimated that at least 75 percent of all vegetable seeds are treated with captan. From information received from growers and grower associations, it is also likely that at least 25 percent of all small berries, including blueberries, blackberries and raspberries are treated with captan. The United States Department of Agriculture (USDA) and the Captan Task Force have provided data indicating that the post-harvest use of captan, particularly on apples, cherries and pears, is significant (Refs. 20 and 37). In the United States, at least 1 million tons of apples and approximately 261,000 tons of pears receive this treatment annually. Industry also estimates that about 30,000 of the 50,000 tons of cherries exported from the State of Washington to Canada each year, and an additional 17,000 tons sold on the the domestic market, are treated with a captan/benomyl mixture. EPA estimates that captan is used alone or in combination with another fungicide as a post-harvest treatment on approximately 25 percent of all apples, 35 percent of pears and 33 percent of cherries.

Captan is also applied to packing boxes used for storing and shipping of fruits and vegetables. Household uses of captan include applications to home gardens and orchards. Captan is registered for use on ornamentals, including house plants. It is also used as a preservative or protectant for awnings, draperies, and leather goods and is incorporated into paints, paper, paste (wallpaper flour), and plastic.

A. Legal Background

Before a pesticide product may be lawfully sold or distributed in either intrastate or interstate commerce, the product must be registered by EPA (FIFRA sections 3(a) and 12(a)(1)). A registration is a license allowing a pesticide product to be sold and distributed for specified use instructions, precautions, and other items and conditions.

In order to obtain a registration for a pesticide under FIFRA, an applicant must demonstrate that the pesticide satisfies the statutory standard for

registration. The standard requires, among other things, that the pesticide perform its intended function without causing "unreasonable adverse effects on the environment," as defined in FIFRA section 2(bb), or any unreasonable risk to man or the environment, taking into account the economic, social and environmental costs and benefits of the use of any pesticide. This standard requires a finding that the benefits of the use of the pesticide exceed the risks of use, when the pesticide is used in compliance with the terms and conditions of registration or in accordance with commonly recognized practices.

The burden of proving that a pesticide satisfies the statutory standard is on the proponents of registration and continues as long as the registration remains in effect. Under FIFRA section 6, the Administrator may issue a Notice of Intent to Cancel the registration of a pesticide product whenever it is determined that the pesticide product causes unreasonable adverse effects on the environment. EPA created the Special Review process to facilitate the identification of pesticide uses which may not satisfy the statutory requirements for registration and to provide an informal procedure to gather and evaluate information about the risks and benefits of these uses.

A Special Review is initiated if a pesticide meets or exceeds the risk criteria set out in the regulations at 40 CFR Part 154. EPA announces that a Special Review is initiated by issuing a notice in the Federal Register. Registrants and other interested persons are invited to review the data upon which the Special Review is based and to submit data and information to rebut EPA's conclusions by showing that EPA's initial determination was in error, or by showing that use of the pesticide is not likely to result in any significant risk to human health or the environment. In addition to submitting rebuttal evidence, persons wishing to comment may submit relevant information to aid in the determination of whether the economic, social and environmental benefits of the pesticide outweigh the risks of use. After reviewing the comments received and other relevant material obtained during the Special Review process, EPA makes a decision on the future status of registrations of the pesticide.

The Special Review process may be concluded in various ways depending upon the outcome of EPA's risk/benefit assessment. If EPA concludes that all of its risks concerns have been adequately rebutted, the pesticide registration will be maintained unchanged. If, however, all risk concerns are not rebutted, EPA will proceed to a full risk/benefit assessment. In determining whether the use of a pesticide poses risks which are greater than its benefits, EPA considers possible changes to the terms and conditions of registration which can reduce risks and the impacts of such modifications on the benefits of use. If EPA determines that such changes reduce risks to the level where the benefits outweigh the risks, it may require that such changes be made in the terms and conditions of the registration. Alternatively, EPA may determine that no changes in the terms and conditions of a registration will adequately assure that use of the pesticide will not pose any unreasonable adverse effects. If EPA makes such a determination, it may seek suspension, and, if necessary, cancellation. In either case, EPA must issue a Notice of Intent to Suspend or a Notice of Intent to Cancel the registration. If the Notice requires changes in the terms and conditions of registration, cancellation may be avoided by making the specified changes set forth in the Notice, if possible. Adversely affected persons, including registrants and applicants for registration may also request a hearing on the suspension or cancellation of a specified registration and use, and if they do so in a legally effective manner that registration and use will be continued pending a decision at the close of an administrative hearing.

B. Regulatory History

1. *Rebuttable Presumption Against Registration.* On August 18, 1980 EPA issued a Notice of Rebuttable Presumption Against Registration (RPAR) and Continued Registration of Pesticide Products Containing Captan (45 FR 54858). This action initiated what is now called the Special Review process. The need for a Special Review of captan was based on EPA's finding that registration of pesticide products containing captan met the risk criteria set forth in 40 CFR 162.11(a)(3) relating to oncogenicity and mutagenicity. Comments were solicited from registrants, applicants for registration and the public, on EPA's finding that products containing captan met or exceeded these risk criteria.

In the Notice initiating the Special Review, EPA also solicited evidence on other possible adverse effects of captan that while not being the bases for issuing the RPAR (referred to as Position Document 1 or PD 1), were of concern. These effects included fetotoxicity/teratogenicity, hypersensitivity, and acute toxicity to aquatic wildlife.

Registrants and applicants were required to submit evidence in rebuttal of the presumption against registration. EPA sought information regarding the risks posed by captan to man or the environment and the benefits from EPA registered uses of captan.

2. *Preliminary Notice of Determination and Notice of Intent to Cancel: Captan Position Document 2/3 June, 1985*—a. *Oncogenicity.* This section provides a summary of EPA's proposed decision (PD 2/3) on captan, issued in June, 1985 (Ref. 55). As part of the Special Review process, EPA reviewed all comments and data submitted in response to the captan RPAR/PD 1. Data submissions included additional studies of chronic exposure to captan in the mouse and rat. EPA evaluated these data and concluded that the studies showed statistically significant increases in incidence of tumors in the gastrointestinal tract in mice (Refs. 4 and 7) and kidney tumors (benign and malignant combined) in male rats (Ref. 24).

Using a weight-of-evidence approach, captan was classified as a Group B_2 (probable human) carcinogen under EPA proposed Guidelines for Carcinogen Risk Assessment (49 FR 46294, Nov. 23, 1984). Specifically, the criteria used were that there was sufficient evidence of an increased incidence of tumors (a) in multiple species or strains of test animals; or (b) in multiple experiments, for example with different dose levels or routes of administration; or (c) to an unusual degree in a single experiment with regard to high incidence, unusual site or type of tumor, or early stage of onset.

The classification of captan as a Group B_2 carcinogen was based on data showing statistically and biologically significant oncogenic responses in both sexes of mice (Refs. 4 and 7) and in male rats (Ref. 24). Supporting evidence included captan's structural activity relationship with folpet and captafol both of which have demonstrated oncogenic effects (Ref. 8) in certain laboratory animals; and captan's mutagenic effects in microbial systems and *in vitro* cell assays (Ref. 46).

b. *Dietary exposure and risk.* EPA's principal concern was the risk of cancer to humans through dietary exposure to captan. Adequate residue data upon which EPA could base an estimate of dietary risk were not available at the time Position Document 2/3 (PD 2/3) was issued. Therefore EPA used the highest residue levels that are legally

permissible, the tolerance levels, as a basis for the dietary risk estimates. Risks were also based on a worst-case assumption that 100 percent of the food crops are treated with captan. Using this assumption, the upper bound estimate of total lifetime dietary risk for the total U.S. population is 10^{-4} to 10^{-5}. A dietary oncogenic risk of 10^{-5} means that statistically one additional case of cancer is estimated to occur for every 1,000 individuals as a result of ingesting captan residues in or on foods consumed.

c. *Non-dietary exposure and risk.* EPA calculated the oncogenic risk from non-dietary exposure to captan. Without protective measures, the upper bound estimates of risk to agricultural applicators and mixer/loaders from combined dermal and inhalation exposure ranged from 10^{-7} to 10^{-6}. Using exposure data from studies of exposure to captan from picking strawberries that have been treated with captan, EPA's upper bound estimates of lifetime risk for field workers ranged from 10^{-6} to 10^{-4}.

For non-agricultural end-users of non-food products containing captan, the upper bound estimates of risk included 10^{-5} to 10^{-4} for human exposure to pet shampoos (this use is no longer registered), 10^{-5} for exposure to commercial applicators of oil-based paints (if no gloves are worn), and 10^{-6} for aerosol sprays.

d. *Other toxicological concerns*—i. *Mutagenicity.* As documented in the RPAR, captan has been shown to be mutagenic in *in vitro* experiments in lower organisms and the following *in vitro* mammalian cells in cultures: SV40 transformed human fibroblasts, chinese hamster lung fibroblasts, and in chinese hamster ovary V79 cells (this last study, Ref. 46, was not included in the RPAR).

A heritable translocation study was performed by Stanford Research Institute (SRI) for EPA (Ref. 40). This study was described in the RPAR. One translocation was found in the high dose group which would normally be sufficient to classify captan as positive for heritable translocations; however one translocation was also seen in the negative control group. This study has been evaluated as negative, equivocal, or positive at various times. Before the PD 2/3 was published, however, a committee of experts in the field of heritable translocation testing was formed by EPA. This group was charged with evaluating all heritable translocation tests available to them. This group of experts has evaluated the SRI captan heritable translocation study as negative (Ref. 14). EPA accepts their assessment of this study.

In summary, as documented in the PD 2/3, captan has been shown to be mutagenic in *in vitro* experiments in lower organisms, but the results in the *in vivo* experiments were evaluated as negative. EPA concludes that captan is either non-mutagenic *in vivo* or possesses such a low mutagenic capacity in the *in vivo* assays used for quantitative heritable mutagenic risk assessment that it is not possible to detect its mutagenic activity. Although captan may be able to cause somatic mutational events which are potentially associated with captan's oncogenic problem, the risk to humans of heritable mutagenicity is extremely low or does not exist and does not warrant further testing at this time.

ii. *Fetotoxicity/teratogenicity.* EPA remained concerned in the PD 2/3 regarding the potential for fetotoxic/teratogenic effects from the use of captan and three studies received after the RPAR/PD 1 was issued were discussed in the document. In one study in the rabbit, no teratogenic effects were observed (Ref. 6), but two studies in the Golden Syrian Hamster were suggestive of teratogenicity but not conclusive (Refs. 15 and 39). EPA asked for additional information on the Golden Syrian Hamster studies to help clarify the studies' findings.

The registrant submitted additional information after EPA issued the PD 2/3. EPA is now able to conclude that captan is not a teratogen.

iii. *Reproductive effects.* In the PD 2/3, EPA expressed its concerns regarding the potential for reproductive effects resulting from dietary exposure to captan. Laboratory animal studies demonstrated that captan caused a decrease in pup litter weights.

In determining the acceptability of dietary risk, EPA typically calculates the maximum amount of residue a person should consume from a toxicological point of view and compares it to the amount of residue a person is likely to consume. So long as the likely residue is less than the maximum allowed, risks are assumed to be acceptable. In the PD 2/3, the specific concern expressed was that the theoretical maximum residue concentration (TMRC) exceeded the allowable daily intake (ADI) by 63 percent. In calculating the TMRC, EPA assumed that exposure to captan for a particular commodity occurred at the tolerance level and that 100 percent of the commodity was treated with captan.

Since the issuance of the PD 2/3, EPA has reviewed data which allow for a better estimation of the actual dietary residues to which people are likely to be exposed. Using the refined exposure estimates, EPA has now calculated that only 1.2 percent of the ADI is utilized for the overall U.S. population and that only 4.1 percent is utilized by the subpopulation with the greatest exposure (i.e., non-nursing infants). EPA is consequently no longer concerned with captan's potential for reproductive effects.

iv. *Hypersensitivity.* In issuing the RPAR/PD 1 on captan, EPA had requested additional information concerning the potential for allergic reactions to captan. EPA received no additional information before issuing the PD 2/3 but did receive additional data after that time. Based on a primary dermal irritation and sensitization study in the guinea pig, EPA has now concluded that captan is a mild irritant and moderate skin sensitizer (Ref. 32). There have also been reports of workers exposed to captan who have developed skin irritation. No additional data have been required by EPA. Based on these findings, EPA specified in the Registration Standard and amendments that labeling include the use of protective clothing. EPA also specified that labelling of all manufacturing and end use products containing captan include the following statement: "May cause allergic skin reaction."

v. *Risks to aquatic organisms.* EPA had expressed its concern in the captan RPAR/PD 1 about the toxicity of captan to aquatic organisms. The rainbow trout (*Salmo gairdneri*) and bluegill (*Lepomis macrochirus*) 96 hour LC_{50} values are 73.2 (66.6–80.7) and 141 (119–167) ug/1 respectively. Comments were received from Stauffer Chemical Company point out that the risk criteria under 40 CFR 162.11 assume direct application to water and that there are no registered aquatic uses of captan. Aquatic contamination could occur only indirectly i.e., through drift, runoff or leaching. Stauffer's rebuttal of the aquatic risk criterion was accepted by EPA (Ref. 45). There are no aquatic uses of captan and the available data show that captan hydrolyzes rapidly in water (half-life of 1 to 2 days, usually ½ day or less (Ref. 44). The potential risks from indirect contamination are likely to be localized and would be expected to be minor.

e. *Preliminary benefit assessment.* EPA conducted a preliminary analysis to assess the benefits associated with the use of captan. This analysis was based on data made available by the USDA, registrants, and other sources. EPA assessed the economic impact for growers and consumers if captan were cancelled and an assessment was made of the likely shift to alternative disease control programs. EPA expressed its

concern that fungicides as a class present toxicological problems and that cancellation of captan might encourage users to switch to alternative chemicals that are equally or more toxic. However, for many chemicals the data base was incomplete and EPA was not able to judge the relative toxicities of the alternatives as compared to captan. Some of these data were later obtained as part of EPA's Registration Standards process. This issue is addressed in Unit VI of this Notice which summarizes EPA's risk/benefit assessment and conclusion of this Special Review of captan.

The benefits of captan were assessed in terms of the economic impacts which would result if its uses were cancelled and users were forced to employ available alternatives. EPA concluded that there would be moderate economic impacts on the ornamental plant industry due to the loss of captan use on carnations ($6 to $12.6 million). It was predicted that resistance to the available alternatives to captan for carnations would build up within 2 years. Moderate impacts were also expected to occur if captan were not available for the following uses: almonds ($1.4 million), apples ($0.9 to $3.3 million), apricots ($0.4 to $0.7 million), bushberries ($3.5 to $4.0 million), nectarines ($0.7), peaches ($2.3 to $5.0 million) and strawberries ($5.9 million). The impact if captan were not available as a seed treatment was estimated at up to $9.2 million overall, although the per acre impact was estimated to be minor.

Although not quantified, it was estimated that cancellation of home garden uses of captan could result in an increase in the costs of disease control as several of the alternatives to captan were more expensive.

For all other uses, EPA estimated that if captan were not available the impacts to growers and consumers would be minor. EPA did not expect any measurable impact on nationwide production or prices of food, or any other aspect of the agricultural economy.

f. *Risk/benefit analysis and proposed regulatory action—*

i. *Agricultural uses: food uses.* As a result of EPA's review of the risks and benefits associated with the use of captan, the EPA issued a Position Document (PD) 2/3 in which EPA proposed to cancel or deny registrations of products containing captan for use on food and feed crops. However, it was proposed that food uses would be retained in EPA's final decision on captan if data were submitted showing that captan residues in or on food were sufficiently lower than the tolerances used in calculating dietary exposure to captan in the PD 2/3, or that alternative application methods would sufficiently reduce dietary exposure to captan.

Captan was registered for use on seeds without submission of data to establish tolerances for the food and feed commodities derived from the treated seeds. In the PD 2/3, EPA assumed that the dietary risks to humans from residues resulting from captan seed treatments would be insignificant. However, EPA took the position that seed treatments will result in residues in the raw agricultural commodity, and, in the absence of data to demonstrate otherwise, required the submission of data to establish appropriate tolerances for those residues. These data must be submitted to EPA by July 6, 1989.

EPA decided to continue to allow the feeding of detreated corn seed to cattle and hogs up to 14 days before slaughter if the residues are less than 100 ppm. The tolerances that allow the feeding of captan detreated corn seed were established under a raw agricultural commodity tolerance regulation 40 CFR 180.103 and in conjunction with a feed additive tolerance regulation 40 CFR 186.500 (formerly codified as 21 CFR 561.65). These tolerances were established under Final Rules published in the **Federal Register** of November 6, 1981 (46 FR 55091 and 46 FR 55113). However, while the **Federal Register** notice (46 FR 55091) which established the feed additive tolerance mentions washing and roasting, thereby implying that these are acceptable methods of detreating the captan treated corn seed, EPA had inadequate data to support either method. These data were subsequently required by the captan Registration Standard issued in March, 1986. In January, 1987, the American Seed Trade Association (ASTA) (who originally requested EPA to set the tolerances: EPA Pesticide Petition No. 3E1367 and EPA Food Additive Petition No. 3E1367) proposed to EPA that ASTA would not submit data supporting the feed additive tolerance but would instead develop alternate disposal methods for captan treated corn seed (over-sowing/incineration) which would allow for the revocation of the feed tolerance for this use. The data were not submitted in support of this tolerance and EPA will propose to revoke the feed additive tolerance through a Notice in the **Federal Register**.

ii. *Agricultural uses: Non-food uses.* EPA did not propose cancellation of non-food uses of captan. However, it proposed that the risks to applicators, mixer/loaders and field workers must be reduced by modifying the terms of registration. For applicators and mixer/loaders, EPA proposed that labels be amended to require them to wear impermeable gloves and dust masks. For field workers, EPA proposed that labels be amended to require the use of water resistant gloves such as leather or other synthetic materials when working in captan treated fields. It was estimated that these measures would result in reducing the risk (by 80 percent) to 10^{-6} for applicators and mixer/loaders and (by 90 percent) to 10^{-8} to 10^{-7} for field workers.

iii. *Non-agricultural uses.* The risks to industrial mixer/loaders and applicators incorporating captan into plastics, paints and cosmetics were estimated as negligible as long as they wear protective clothing and dust masks. The risk to mixer/loader/applicators incorporating captan into adhesives was estimated at 10^{-5} and EPA proposed to require the use of protective clothing or equipment during this procedure which would reduce the risk to adhesive applicators significantly (by 80 to 90 percent). EPA proposed that gloves, protective clothing and respirators be required at all phases of the application process (dust masks for incorporation into cosmetics) for all non-agricultural uses.

EPA also calculated the potential oncogenic risks to users of non-food end-use products containing captan. For exposure to captan treated plastics and to captan treated packing boxes, the risks were estimated to be negligible. The risks from certain end-use products were low enough that EPA proposed no regulatory action. For example, the risks from exposure to surface sprays and pet powders containing captan were estimated at 10^{-9} and 10^{-8}, respectively, and EPA concluded that the benefits outweighed the risks from using these products. The benefits of the availability of sanitizing deodorant powdered hand soap containing 0.87 percent captan (Vancide 89) as an antimicrobial agent were also believed to outweigh the risks which were estimated, using a worst-case scenario, at 10^{-6} to 10^{-5}. EPA expects actual risks to be lower because hands are typically rinsed off right away. In addition, the presence of captan controls bacteria and fungi, which could degrade the product, and pathogenic bacteria which could lead to infections.

Risks from direct exposure to captan treated mattresses and pillows were calculated at 10^{-6} to 10^{-5}. However, it was estimated that the risks would be at least an order of magnitude lower and range from 10^{-7} to 10^{-6} since sheets and pillowcases are usually used over these

products. No regulatory action was proposed for captan treated mattresses and pillows.

Risks from use of captan treated adhesives was estimated at 10^{-7} to 10^{-6} for home use and 10^{-5} for professional uses. No regulatory action was proposed as the benefits were believed to outweigh the risks from captan treated adhesives.

EPA estimated the risk from exposure to water-based paint containing captan to be 10^{-6} and that the benefits outweighed the risk. Exposure to oil-based paint was estimated at 10^{-5} for commercial applicators and EPA proposed that the labels for this use be amended to require that impermeable gloves be worn during application. It was estimated that the use of impermeable gloves would reduce risks by 80 percent and would result in the risks from oil-based paints being outweighed by the benefits.

The use of gloves was also proposed to reduce the risks from exposure to dog and cat shampoos containing captan. It was estimated that the calculated risks of from 10^{-5} to 10^{-4} would be reduced to 10^{-6} to 10^{-5}. (There are no remaining registrations for pet shampoos.) Exposure to pet powders containing captan was estimated at 10^{-6} and EPA did not propose the use of gloves with this product. Although powders were erroneously mentioned with shampoos in the PD 2/3 Unit IV.E.3.b.4, Unit IV.F.3.d.2 correctly summarized EPA's proposed action regarding pet powders and shampoos. EPA considered that the benefits outweighed the risks from these captan uses.

3. *Registration Standard and Data Call-In.* In March, 1988, as part of EPA's Registration Standards program, EPA published the Guidance for the Reregistration of Pesticide Products Containing Captan (referred to as the Registration Standard). Certain deficiencies in the captan data base were identified during EPA's initial assessment of this chemical. A Data Call-In Notice (DCI) was issued on April 29, 1985, requesting residue chemistry and toxicological data. In addition to these data, the Registration Standard identified data gaps in the following areas: product chemistry, toxicology, environmental fate, wildlife and aquatic organisms and residue chemistry. The Registration Standards program involves a thorough review of the scientific data base underlying pesticide registrations and the identification of essential but missing studies which may not have been required when the product was initially registered, or studies that are now considered insufficient. As part of the Registration Standards program, all currently available data on a pesticide active ingredient are reviewed and evaluated and are considered in the development of EPA's regulatory position on the pesticide.

4. *Captan Registration Standard—Amendments.* On April 25, 1988, EPA again notified all registrants of manufacturing-use products (MPs) containing captan of the data submissions required by the Registration Standard.

In response to EPA's issuing the captan Registration Standard, registrants of technical captan formed a Captan Task Force (initially called the Captan Task Group). The Task Force represented the three major manufacturers of captan: Chevron Chemical Company, Stauffer Chemical Company (replaced by ICI Americas, Inc. in 1987) and Makhteshim-Agan (America), Inc. These registrants agreed to share the responsibility and costs of developing the data identified as data gaps in the Registration Standard; however, the Captan Task Force indicated to EPA that they would only develop the residue data required to support the continued registration for certain specific food crop uses.

On April 24, 1987, all registrants were mailed a copy of the captan Registration Standard and a Data Call-In amendment which notified registrants that the Captan Task Force did not intend to develop data for all captan registrations. The end-use registrants, who had not received the Registration Standard initially, were given 90 days to respond to EPA if they intended to develop these data; if not, the unsupported food use patterns were to be deleted from all EPA-registered captan product labels.

Registrants were also notified that EPA had reevaluated certain data requirements required by the Registration Standard and that these requirements were being amended. These amendments reflected EPA's agreement to requests made by the Captan Task Force regarding the relabeling of existing stocks. The required time limits for the relabeling of existing stocks of registered captan products in the channels of trade was extended by 1 year. The changes were required to be in effect by March, 1988. An additional extension of 1 year, until March, 1989, was granted in January, 1988.

EPA also clarified and expanded some protective clothing and precautionary labeling changes mandated in the Registration Standard. For example, the earlier requirement that "impermeable gloves" be worn while handling captan products was amended to "chemical resistant gloves". The required endangered species precautionary statements were deleted to reflect an Agency-wide delay in implementing its endangered species policy. In addition, a crop rotation restriction was removed.

5. *Notice of Intent to Suspend.* A Notice of Intent to Suspend (NOIS) was issued on December 7, 1988. This NOIS was sent to all registrants informing them of EPA's intent to suspend certain formulations and agricultural food and feed use patterns of captan products for which residue chemistry data had been required by the Data Call-In or the captan Registration Standard, but had not been provided. Registrants were initially given 30 days to respond to this Notice or to request a hearing. However, because of a technical error on the part of EPA, this Notice of Intent to Suspend is being revoked. Registrants will be notified of the revocation. EPA is considering issuing a new Notice of Intent to Suspend the agricultural uses for which residue data have not been received. This suspension action, part of the Registration Standards program, is authorized under FIFRA 3(c)(2)(B) and is independent of the Special Review and risk/benefit assessment of captan.

6. *Conclusion of Special Review (PD/4).* EPA's assessment and final decision regarding the risks and benefits associated with products containing captan are set forth in this document. The EPA has received additional data and comments in response to EPA's Position Document regarding captan (PD 2/3, June 1985). This information is summarized and included in the appropriate Units of this document along with EPA's response.

II. Summary of Toxicological Concerns and Agency Evaluation of Comments and Additional Data

A. Oncogenicity

This Unit documents EPA's review of studies of the oncogenic effects of captan and EPA's classification of captan as a B_2 (probable human) carcinogen. This Unit also includes public comments on oncogenicity that have been received since EPA's proposed decision concerning captan was issued in June, 1985.

1. *Rebuttable Presumption Against Registration (RPAR) and PD 2/3.* The Rebuttable Presumption Against Registration, or RPAR (now known as the Special Review process) of captan was initiated in 1980 because of EPA's concerns regarding the oncogenic effects of captan demonstrated in laboratory animal feeding studies. One study in

mice showed significantly elevated incidences of duodenal tumors in males and females following 20-month oral administrations of captan (Ref. 35). Another study showed an increased incidence of hepatomas in males only following 18-month oral administrations of captan (Ref. 22). Preliminary results of a 2-year feeding study available at the time appeared to confirm an increased incidence of duodenal tumors among mice fed captan (Ref. 7). Two long-term rat studies resulted in no significantly increased levels of tumors (Refs. 35 and 18). One rat study (IBT B9287) and one mouse study (IBT B9271) were determined to be invalid by a joint United States/Canadian governmental audit and were not used in evaluating captan's oncogenicity (Ref. 3).

In response to EPA's initiation of the Special Review, the registrant submitted comments regarding the oncogenicity of captan and EPA's evaluation of data. EPA responded to these comments in detail in the Captan PD 2/3 of June, 1985. EPA concluded that the concern for oncogenicity for captan had not been rebutted. Additional studies were also received from registrants and were evaluated by EPA. The additional information on oncogenicity included three long-term feeding studies submitted by the registrants: a high-dose study using CD–1 mice (Ref. 7); a low-dose study in Charles River CD–1 mice (Ref. 4); and a 2-year feeding study in Charles River CD rats (Ref. 24). A detailed discussion of those studies is presented in the Captan PD 2/3.

The data from these studies demonstrate a statistically and biologically significant oncogenic response in both sexes of mice and in male rats. Tumors include adenomas (benign) and adenocarcinomas (malignant) of the gastrointestinal tract in both sexes of mice and kidney tumors in male rats. As further supporting evidence of oncogenicity, EPA noted that captan has mutagenic activity *in vitro* and is structurally similar to two other chemicals, folpet and captafol. Both of these are also oncogenic in laboratory animals and demonstrate mutagenic effects in *in vitro* systems.

Thus, using a weight-of-the-evidence approach, and following the classification scheme set forth in EPA's Carcinogenic Risk Assessment Guidelines (proposed: November 23, 1984, 49 FR 46294; finalized: September 24, 1986, 51 FR 33992), captan was categorized as a B2 (probable human) carcinogen. The overall potency or Q_1^* value for captan was estimated by calculating the geometric mean of the five Q_1^* values for male and female mice in two studies (Refs. 4 and 7) and for male rats (Ref. 23). The resulting Q_1^* for captan was 2.3×10^{-2} $(mg/kg/day)^{-1}$ (PD 2/3 Unit II.2). The rationale for combining organ sites and tumor types is outlined in the National Toxicology Program—Board of Scientific Counselors Meeting, September 23 and 24, 1982 (Ref. 51).

In accordance with section 6 of FIFRA, EPA's proposed decision to cancel certain uses of captan due to the identified risks of oncogenicity, was submitted to the FIFRA Scientific Advisory Panel (SAP) for review. An open meeting was held by the SAP on September 26, 1985. The SAP's report of October 4, 1985, is reprinted in its entirety in Unit V. of this Notice.

One issue raised with the SAP was whether the panel agreed with EPA:s qualitative assessment (i.e. weight-of-the-evidence conclusions) of the oncogenic potential of captan. After reviewing the evidence, the SAP's findings were that one mouse study demonstrates oncogenic effects in the duodenum of mice exposed to a high dose of captan (Ref. 7); and that two other studies are less convincing, but supportive because they indicate tumors at the same site (Refs. 4 and 35). The Panel found the rat studies equivocal, at best, in indicating oncogenicity.

The SAP was also asked to comment on EPA's calculation of the geometric mean of the Q_1^*s from five oncogencity studies to determine the potency value (Q_1^*) for captan. The Panel expressed its reservations about EPA's procedures and assumptions in determining and using Q_1^* values. Their specific criticism of the way EPA had calculated the Q_1^* for captan was that the geometric mean was calculated using studies that were not of equal value. EPA's reevaluation of the studies showing captan's oncogenic effects and calculations of a new Q_1^* for captan are discussed in Unit II.A.4. and 6. of this Notice.

2. *Registrants comments on the PD 2/3.* Stauffer Chemical Company and Chevron Chemical Company submitted their comments on the Captan PD 2/3 in August, 1985. Both companies have essentially the same discussions as related to the toxicology and risk assessment of captan. These comments and EPA's response to these issues are summarized below:

a. The registrants expressed their opinion that captan is not carcinogenic in rats. They submitted historical control data and stated that the EPA focused on only one of three chronic rat feeding studies: The IRDC, 1982 study. In this study, although the evidence for oncogenicity is poor, there is a positive statistical trend for renal tumors in males; however, there are no statistically significant pair-wise comparisons between any treatment group and the controls. The two other rat studies are negative.

EPA response: EPA disagrees with the registrant and maintains that captan may be considered weakly oncogenic in the IRDC rat study. EPA used the more sensitive Cochran-Armitrage trend test, rather than the Fisher's pair-wise exact test for statistical significance. The trend test utilizes information from all experimental groups which becomes more important as the number of dosed groups increases.

In addition, the structure activity relationship of captan should also be considered. Captafol, a pesticide cancelled voluntarily by the registrant in 1987 after a Special Review had been initiated, has the same ring structure as captan, and is also initially metabolized to tetrahydrophthalimide (THPI). The lesions of concern, renal cortical tubular adenomas and carcinomas have been observed to increase in frequency with increasing doses of captafol in the same strain of rat (Charles River CD) as in the IRDC 1982 study on captan. This evidence adds support to the position that the renal lesion may be related to the ingestion of captan and the subsequent metabolism to a derivative of the THPI moiety.

The IRDC rat historical control data referred to by the registrant in support of their argument that captan is not carcinogenic in the rat, indicate that the average incidence of renal cortical neoplasms is 0.8 percent in male rats, based on a male population of 1279 (14 studies). The range is from 0 to 3.9 percent. This is lower than the incidence in the high dose group after captan treatment (4/57, or 7 percent, had renal tumors (excluding rats from the 1-year sacrifice)). The concurrent male control group of the captan rat study also had a renal tumor incidence of 1/60, or 1.7 percent which is within the range of historical values. Therefore the renal tumors are considered related to treatment.

In summary, EPA's position that captan may be considered weakly oncogenic in the rat is supported by the following evidence: (a) There are statistically significant differences when the trend test is used instead of the less sensitive pair-wise comparisons; (b) captan's structure-activity relationship to captafol which also appears to be associated with a slight increase in the incidence of renal cortical neoplasia; and (c) the incidence of renal tumors in male controls of the captan study is

within the range of the historical control data while the incidence of tumors in the high dose group is outside both the historical and concurrent control range.

b. Chevron/Stauffer claimed that no oncogenic effects were observed at doses of up to and including 800 ppm in the mouse (Ref. 4).

EPA response: Captan is associated with gastrointestinal tumors at doses of 6000 ppm and above in 3 studies in the mouse (Refs. 4 and 7). Although the data do not unequivocally indicate oncogenic potential at lower doses, they are suggestive of such potential. EPA combined tumors of the glandular stomach, duodenum, jejunum and ileum in the PD 2/3. This practice of combining various organs is controversial, as the registrant indicated. EPA cited a National Toxicology Program Board of Scientific Counselors Meeting (September, 1982) which presented a list of acceptable organ combinations including glandular tissues of the stomach and small intestine. Stauffer also quotes from the same document that neoplasia of the glandular stomach is usually evaluated independently. Separation of the stomach data, however, does not significantly alter the conclusions.

The primary issue raised by Stauffer is whether or not EPA recognizes a threshold in carcinogenesis for intestinal tumors due to captan. In order for a threshold mechanism to be considered in analyzing oncogenicity data, several criteria need to be met and although it may be possible that a threshold does exist for intestinal tumors due to captan, the data supporting this position do not yet exist. Examples of information that may aid in assessing whether a threshold for captan carcinogenicity exists are as follows: (a) Extensive testing at low doses demonstrating the absence of pre-neoplastic or neoplastic changes below the alleged threshold level; (b) an identified change in metabolism or a secondary mechanism that occurs only at higher doses; this high dose model in the laboratory animal must be shown to be applicable in assessing potential oncogenicity in man; and (c) the nature of the oncogenic compound or metabolite must be identified and its presence demonstrated only at levels above the alleged threshold.

c. Stauffer stated that the current epidemiological data do not support a captan-related oncogenic risk to man. They cited a retrospective cohort epidemiologic study involving workers at the Calhio plant where technical captan is manufactured.

EPA response: The epidemiological study performed at the Calhio plant indicated that mortality due to malignant neoplasms was not increased. Although deaths (18) appeared greater than expected based on the national average (11), the increase was related to cardiovascular effects rather than neoplasia. This study, however, has several shortcomings. Only 18 of the employees were exposed to captan for longer than 20 years. The small population examined (134 males), small number of deaths (18 males), and short observation period (23 years) make it difficult to determine the oncogenic potential of captan in the workplace. Although the age-adjusted table for malignant neoplasms of the small intestine indicates that the incidence has stabilized (.3), this is an insensitive indicator.

3. *Other comments on oncogenicity.* The Natural Resources Defense Council, Inc. (NRDC) and the California Rural Legal Assistance Foundation (CRLAF) submitted their amended comments in response to EPA's PD 2/3 on August 12, 1985. They stated their opinion that captan is a carcinogen producing statistically significant increases in tumor incidence in both sexes of mice and in male rats.

EPA response: The NRDC/CRLAF are correct in stating that captan produced adenocarcinomas of the digestive tract in both sexes of mice in three studies, and that this tumor type is not commonly observed in rodents. They also state that kidney tumors were observed in male rats in one study. EPA has determined that these rat data show only a borderline increase in kidney tumors; however, this increase was taken into consideration in determining the oncogenicity classification and risks from captan. EPA supports the classification of captan as a B_2 (probable human) carcinogen.

4. *Toxicology Branch Peer Review.* The Office of Pesticide Program's Toxicology Branch Peer Review Committee reviewed the oncogenicity data on captan in December, 1985. The committee considered the criteria in EPA's proposed guidelines for classifying a carcinogen (49 FR 46294). After careful reevaluation of all the evidence, the committee determined that captan meets all the criteria for category B_2, any one of which alone can be sufficient for such classification. The evidence for carcinogenicity includes the following: (a) Captan produces an increased incidence of renal cortical tubular cell neoplasms in male Charles River CD rats and an increased incidence of uterine sarcomas in Wistar rats; (b) captan produces an increased incidence of intestinal neoplasms in $B6C3F_1$ mice; in ICR-Derived CD-1 mice, tumors appeared early and there is a dose-related trend for both sexes; and in Charles River CD-1 mice (tumors appeared after 9 months); and (c) captan demonstrated mutagenic activity and is structurally related to two oncogens (captafol and folpet), which also have mutagenic activity.

5. *Captan Task Force rebuttal of the Toxicology Branch Peer Review.* The Captan Task Force, formed by the registrants, submitted their rebuttal to the Toxicology Branch Peer Review of captan. They expressed their opinion that there is no substantive evidence that captan presents a risk as a human oncogen. They held that the nature of the murine intestinal tumors, the lack of credible systemic tumors elsewhere (either in the mouse or the rat) and an evaluation of the probable mechanism of action, all lead to the conclusion that captan is not a probable human carcinogen. The arguments presented by the Captan Task Force are addressed below.

a. *Oncogenicity of captan in rats.* i. The Task Force stated that EPA's use of the Cochran-Armitage trend test to evaluate kidney tumors in the two-year oral toxicity carcinogenicity study of captan in Charles River CD rats (Ref. 24) is inappropriate because the incidence is too low. They noted that pair-wise comparison indicates no significant increase in the incidence of renal tumors in this study.

EPA response: Several factors are considered in determining the relevance of increased tumor incidence, including the percent increase in tumors over concurrent and historical controls as well as pair-wise and trend statistical analyses. In this case, the incidence of renal tumors in male Charles River CD rats was increased over both concurrent (treated—7 percent vs control—2 percent, excluding animals sacrificed at 1 year and deaths prior to 1 year) and historical controls for 14 studies (1279 rats). Historical controls for adenomas ranged from 0 to 1.7 percent with a mean of 0.4 percent, while the range for adenocarcinomas was 0 to 2.1 percent with a mean of 0.2 percent. Therefore, while the Task Force is correct that the pair-wise comparison is not statistically significant, the incidence appears to be treatment related. EPA agrees with the registrant that the Cochran-Armitage trend test may be inappropriate with low tumor incidence; however, it would not alter the conclusion that renal tumors are associated with the administration of captan in this study since (i) it is a rare tumor; and (ii) incidences are outside the historical and concurrent control ranges.

ii. The Task Force held that there was absolutely no evidence of renal tumors in the other two chronic rat studies at very high dose levels: A bioassay of captan for possible carcinogenicity in Osborne-Mendel rats (Ref. 35) with doses up to 6050 ppm (time weighted average); and a Life-Span oral carcinogenicity study of captan (Merpan) in Wistar Cpb:Wu rats (Ref. 34) at doses of 2000 ppm.

EPA response: The three rat studies were performed on 3 different strains, Charles River CD, Osborne Mendel and Wistar Cpb:Wu rats. Therefore, they cannot be considered as replicates of the same study. Two negatives would not necessarily neutralize one positive study. In addition, Chevron has recently submitted a subchronic inhalation study in the CD rat in which renal lesions (hyaline droplet nephropathy) occurred at all doses. The literature indicates that this lesion has on occasion been associated with low level increases in renal tumors.

iii. The Task Force disagreed with EPA's finding on the incidence of uterine sarcomas. They found that induction of uterine sarcomas in the Wistar rat (Ref. 34) was not confirmed in studies of the Osborne Mendel rat (Ref. 35) or the Charles River CD rat (Ref. 24).

EPA response: Again, EPA does not accept that two negative studies in different strains of the rat would neutralize one positive study. In addition, the incidence (8 percent) of uterine sarcomas in the high dose Wistar Cpb:Wu rats is substantially above concurrent controls (0 percent) and historical controls (based on 7 studies, 422 rats, range of 0–2 percent, mean 0.2 percent). In the absence of additional information, captan will be considered a weak oncogen for uterine sarcomas in this strain of rat. Therefore captan appears to be a potential, albeit weak, rat oncogen.

b. *Oncogenicity of captan in mice.* The following comments were submitted by the Captan Task Force regarding the oncogenicity of captan in the mouse.

i. Captan is rapidly detoxified in mammals via two mechanisms. First, thiol-containing compounds such as glutathione react with captan, and secondly, hydrolysis, particularly rapid at alkaline pH levels, serves to neutralize captan. The active moiety, thiophosgene, formed during captan metabolism, can be rapidly detoxified by additional reaction with thiol groups. Other reactions with sulphate and water (hydrolysis) also serve to neutralize the thiophosgene.

ii. Studies on the effects of captan show local, not systemic tumors. The rapid detoxification/hydrolysis of captan noted above prevents the parent compound from entering the systemic circulation.

iii. There is no bioaccumulation of captan or its metabolites.

iv. Large oral doses of captan give no evidence of clastogenic damage in the target tissue (duodenal mucosa) as noted by Chidiac and Goldberg (Ref. 10).

EPA response: EPA agrees with the Task Force that captan does appear to be rapidly metabolized; that tumors in mice are localized in the intestines; and that there is no bioaccumulation in, or clastogenic damage to, the duodenal mucosal cells. However, these factors do not alter the fact that tumors do occur in mice. These factors do not provide a basis for altering the oncogenic classification of captan.

c. *The structure activity relationship of captan with captafol and folpet.* The Task Force disagreed with EPA's finding that the increase in renal tumor incidence at a dose level of 1200 ppm in a study of captafol supports EPA's position that captan causes renal tumors. Captafol induces renal tumors only at a dose level that also produces renal tubular cell toxicity and therefore the tumors are attributable to prolonged injury and repair in the kidney. The Task Force finds that there is no evidence that captan produces similar toxicity.

EPA response: The structure activity relationship between chemicals is not used to determine the classification of an oncogen but rather as supporting evidence for its classification, depending on the strength of the information. In the case of captan, there is a structural relationship with the fungicides captafol and folpet. As was mentioned above, it has been demonstrated that administration of captan (by a different route of exposure) is associated with renal tubular cell changes. These cell changes have, for other chemicals, been associated with low level increases of renal cortical tumors.

6. *Toxicology Branch Second Peer Review.* The Office of Pesticide Program's Peer Review committee met on April 13, 1988 to reevaluate the classification of captan as a B_2 oncogen, and to determine if the Q_1^* used in the PD 2/3 is still appropriate. In the PD 2/3, the Q_1^* (potency) for captan was calculated using a geometric mean based on the Q_1^*'s from the following studies: male and female mice in a high dose study (Ref. 7) male and female mice in a low dose study (Ref. 4); and from one study of the male rat (Ref. 24).

In reviewing EPA's PD 2/3 on captan, the Scientific Advisory Panel had not found EPA's approach to calculating the Q_1^* for captan useful because the five studies used to calculate the geometric mean were not of equal value.

EPA's initial position in response to the SAP reservations was that although the studies do vary qualitatively, the Q_1^* for each study is sufficiently similar that using a different system of establishing the Q_1^* for captan would not make a practical difference.

During the Second Peer Review of captan the committee examined EPA's laboratory audit of the Bio/dynamics (Ref. 4) 2-year mouse feeding study referred to as the low-dose study. The low incidence of tumors at the highest dose of 6000 ppm in this study was not consistent with the incidence of intestinal tumors at this dose level in both the Chevron (Ref. 7) study and a Stauffer single dose (6000 ppm) study submitted since the PD 2/3 was issued. The audit suggests that there was a problem with achieving and maintaining the appropriate dose levels throughout the Bio/dynamics study (Ref. 4).

In determining the overall Q_1^* for captan, the committee decided to omit the Q_1^* values based on the Bio/dynamics study and the Q_1^* value based on the rat kidney tumors which the SAP had found equivocal. The new overall Q_1^* for captan, based only on the Chevron (Ref. 7) high dose study in male and female mice (geometric mean) is 3.6×10^{-2}.

The committee reaffirmed the classification of captan as a B_2 (probable human) carcinogen based on tumors in two species, mutagenicity and structural activity relationships.

B. Mutagenicity

In initiating a special review of captan, EPA concluded that on the basis of the information then available to EPA, captan exceeded the risk criteria for mutagenicity (45 FR 54938, August 18, 1980). As discussed in Unit I of this Notice, the Toxicology Branch evaluated additional data on mutagenicity prior to issuing the PD 2/3 on captan in 1985. EPA determined that captan shows positive mutagenic activity in gene mutation and chromosomal aberration tests *in vitro* but not *in vivo*. Therefore, EPA concluded that although captan may cause somatic mutational events which are potentially associated with captan's oncogenic potential, the risk to humans of heritable mutagenicity is extremely low or does not exist and does not warrant further testing at this time.

Subsequent evaluation of the mutagenicity data by the Toxicology Branch Peer Review Committee has confirmed EPA's PD 2/3 on the mutagenic potential of captan. The

studies on the mutagenicity of captan lend significant support to its classification as an oncogen, but there is little or no risk of its producing mutagenic effects in humans.

C. Teratogenicity

Information available to EPA prior to the issuance of a Notice initiating the Special Review of captan, indicated that captan might produce other adverse effects including teratogenicity (45 FR 54938). Studies reviewed and evaluated prior to the PD 2/3 included a study in New Zealand white rabbits (Ref. 6) in which no teratogenic effects were observed, and two studies in the Golden Hamster which were suggestive of teratogenicity but not conclusive (Refs. 15 and 39). A Data Call-In (April, 1985) required the submission of another teratology study in the hamster.

Comments on the teratogenicity of captan were submitted by the registrant, Stauffer Chemical Company, in August, 1985. The registrant said that the Roben's hamster study which EPA had cited as being suggestive of teratogenicity, was not consistent with EPA Guidelines. The registrant's position was that captan had been tested exhaustively for potential teratogenicity in mice, hamsters, rats, rabbits and rhesus monkeys and had not been shown to be teratogenic in any species. It was their opinion that an additional hamster teratology study was unnecessary.

EPA response: After the PD 2/3 was issued, additional historical data on the Golden Syrian hamster were submitted by the registrant. EPA's evaluation of these data resulted in the Goldenthal, IRDC study classification being upgraded to core minimum (a classification which means that the study is scientifically sound but incomplete), which then satisfied the guideline requirement for developmental data in one species. Thus, there is no need for another teratology study in the hamster required in the 1985 Data Call-In Notice. A teratogenicity study in rabbits was also considered core minimum. There were no indications of teratogenic effects in either species.

EPA's assessment that captan is not a teratogen in the hamster or the rat (based on Agency accepted studies) was reviewed by the SAP in September, 1985 and the Panel concurred with EPA's judgement.

D. Reproductive Effects

1. *Agency's data evaluation and risk assessment.* EPA's preliminary risk assessment for reproductive effects was based on a three generation study in CORS CD rats (Ref. 24) and a one generation rat study (Ref. 25). While neither the three nor the one generation study was adequate in itself due to the dose selection in each study, each study provided sufficient information for EPA to reach a scientific conclusion on the reproductive toxicity potential of captan. These studies satisfy EPA's reproduction testing requirements.

No compound-related effects were seen at any dosage level in the one-generation study in which captan was given in the diet at dosage levels of 0, 6, 12.5, and 25 mg/kg/day. In the three-generation study, captan was administered in the diet at dosage levels of 0, 25, 100, and 500 mg/kg/day. No treatment-related effects were seen in this study with the exception of a reduction in body weight and food consumption. The reduced parental (male and female) weight gain and reduced food consumption occurred in all but the low dose groups. There was a treatment-related decrease in food consumption in all pup groups except for the 25 mg/kg/day, F1 (first generation) males and F2 (second generation) females, and 100 mg/kg/day females. A decrease in pup litter weights was observed at all dosage levels. The NOEL for toxic effects is 12.5 mg/kg/day and the LEL is 25 mg/kg/day.

A new chronic dog study was recently received and reviewed by EPA. Although this study is classified core grade supplementary (scientifically sound but incomplete), it is sufficient to complete the required data base for the Reference Dose (RfD). These data show that the rat remains the more sensitive species.

To determine whether there is an adequate margin of safety (MOS) between the NOEL for toxic effects and dietary residue levels to which humans might be exposed, EPA calculates the Reference dose (RfD), formerly called the Acceptable Daily Intake (ADI). The RfD is based on the most sensitive NOEL and an uncertainty factor used to account for the interspecies and intraspecies differences and data gaps.

In the PD 2/3, an uncertainty factor of 1,000 was used because of the incomplete data base. Since the data base is now complete, an uncertainty factor of 100 is used with the most sensitive NOEL (12.5 mg/kg/day). The resulting RfD is 1.25×10^{-1} mg/kg/day and is discussed in Unit IILA of this Notice which concerns dietary exposure to captan.

2. *Comments in response to the PD 2/3.* NRDC/CRLAF expressed their concern about the adequacy of the reproduction studies on which EPA had based their estimate of Margins of Safety (MOS).

EPA response: As stated earlier, EPA recognizes that each study had deficiencies. However, when the two studies are considered together, they provide sufficient information regarding captan's reproductive toxicity potential that additional studies are not needed.

EPA believes, as described earlier in this Unit, that when taken together the two reproduction studies submitted by the registrants and described above have satisfied the guideline requirement for data on reproduction effects.

E. Other Toxicological Concerns

1. *The captan metabolite, tetrahydrophthalimide (THPI)—Comments in response to the PD 2/3.* a. NRDC/CRLAF commented that it is now widely recognized that metabolites of pesticide active ingredients can be potentially as dangerous, if not more dangerous, than the parent compound. They stated that although EPA had correctly considered the metabolite THPI in addition to the parent compound, the existing toxicity data base on this metabolite was inadequate.

b. Industry's Captan Task Force commented that the major metabolite (plant and animal) of captan, tetrahydrophthalimide (THPI) has not been implicated as a carcinogen and is not a mutagen.

EPA response: The toxicity of a plant metabolite is considered to be examined when the parent is tested in animal toxicity studies, since any toxicity detected in the study could result from the metabolite as well as the parent, provided that the metabolite is also an animal metabolite. Since THPI is produced both in plants and in animals, EPA believes the available data base is sufficient to reflect the oncogenic potential of THPI.

2. *Hypersensitivity.* In initiating a Special Review of captan, EPA was aware that there were some data associating captan with allergic skin reactions. EPA received no additional information before issuing the PD 2/3. Based on a primary dermal irritation and sensitization study in the guinea pig, EPA concluded that captan is a mild irritant and moderate skin sensitizer (Ref. 33). There have also been reports of workers exposed to captan who have developed skin irritation.

Based on these findings, EPA specified in the Registration Standard and amendments that labeling for captan products include protective clothing. EPA also specified that labelling of all manufacturing and end use products containing captan include the following statement: "May cause allergic skin reaction."

III. Dietary and Non-Dietary Exposure and Risk

A. Dietary Exposure and Risk

In the captan PD 2/3, EPA assumed food residues were at tolerance levels and that 100 percent of a crop was treated in order to estimate dietary exposure of the U.S. population to captan. Exposure was estimated to be 0.1169 mg/kg (body weight)/day. Although these assumptions resulted in a worst-case estimation of dietary exposure they were used in the absence of actual residue data and sufficient current market data. EPA calculated an upper bound estimate of total dietary risk of 10^{-4} to 10^{-3} based on this exposure estimate. Data from market basket surveys available at the time suggested that actual exposure may have been substantially lower; however, concerns regarding the reliability of these surveys prevented EPA from using them as a basis to calculate dietary risk.

The use of captan on seeds had previously been considered a non-food use and therefore establishment of tolerances was not necessary. EPA has since determined that tolerances are required for seed treatments unless radio-labeled studies demonstrate that there is no uptake of residues by the plant. Although EPA realized the need for tolerances for seed treatments at the time of the PD 2/3, no data were available. EPA assumed that residues would be insignificant due to the limited amount of pesticide that could be transferred from the seed coating to the whole plant. Data were required and are expected to be submitted by July 6, 1989. For the purposes of this exposure assessment, EPA considers the residues resulting from seed treatment to make an insignificant contribution to the diet. EPA will review the data when available and modify this position if necessary. No seed treatments are being canceled by this Final Determination due to dietary concerns.

Similarly, in the PD 2/3 EPA had no data on residues on corn seed that had been detreated in accordance with 40 CFR 186.500 (formerly codified as 21 CFR 561.65). EPA believed at that time that there are no detectable residues in cattle and hogs as a result of feeding detreated corn seed. However, residue data required by EPA to support the detreated corn seed tolerance have not been provided and a notice proposing to revoke this tolerance will be issued shortly.

A Special Data Call-In Notice issued in April, 1985, required the submission of a number of studies which could be used by EPA in refining its dietary exposure assessment for captan. Included were residue reduction data which measured levels of both captan and its major metabolite tetrahydrophthalimide (THPI) on a number of commodities after washing, peeling, and/or cooking to better estimate actual residues consumed. Also required were crop residue data for all registered crops and processing studies to determine levels of captan and THPI as well as feeding studies in poultry to determine levels in eggs and tissues.

EPA used these data as well as other data available to revise its dietary exposure assessment. The percentage of crop treated has also been taken into account for this assessment unlike in the assessment presented in the PD 2/3. As a result, the best data available have been used in estimating actual dietary exposure to residues of captan and THPI on each individual commodity. Monitoring data were used whenever possible in determining exposure levels as these data measure residues at the point closest to purchase and thus consumption by an individual. Where monitoring data were not available for a particular commodity or there were an insufficient number of samples upon which to base an estimate, data from field tests were used. Finally, in the absence of both monitoring and field tests, tolerance levels were used (Ref. 16). EPA relied upon feeding studies in order to estimate the residue levels occurring in meat and milk.

As mentioned previously, exposure to residues of captan was estimated to be 0.1169 mg/kg (body weight)/day in the PD 2/3. EPA, in light of the new data and information, now estimates total exposure to be 0.001666 mg/kg/day using EPA's Tolerance Assessment System. Using this exposure estimate, the upper bound lifetime oncogenic risk from dietary exposure to captan ranges from 10^{-4} to 10^{-6} for the overall U.S. population. The oncogenic risk is calculated by multiplying exposure by the oncogenic potency factor or Q_1^* $[3.6\times10^{-3}\ (mg/kg/day)^{-1}]$. The following Table 2 presents the upper-bound risks for individual commodities. The type of data used in estimating exposure are indicated in parentheses.

TABLE 2—UPPER-BOUND LIFETIME ONCOGENIC RISK

Crop	Risk
Almonds (M)	10^{-11} to 10^{-10}
Apples (M)	10^{-9}
Apricots (M)	10^{-8} to 10^{-9}
Avocados (T)	10^{-8} to 10^{-7}
Beans, dry (T)	10^{-7}
Beans, succulent (T)	10^{-7}
Beets (M)	10^{-10}

TABLE 2—UPPER-BOUND LIFETIME ONCOGENIC RISK—Continued

Crop	Risk
Blackberries (M)	10^{-8}
Blueberries (M)	10^{-10}
Broccoli (M)	10^{-8}
Brussels sprouts (T)	10^{-10} to 10^{-9}
Cabbage (T)	10^{-8}
Cantaloupe/muskmelon (FT)	10^{-9}
Carrots (M)	10^{-9} to 10^{-8}
Cauliflower (T)	10^{-8}
Celery (M)	10^{-8}
Cherries (M)	10^{-8}
Collards (T)	10^{-8} to 10^{-7}
Corn, sweet (T)	10^{-7}
Cotton (T)	10^{-8}
Crabapples (M)	10^{-11} to 10^{-10}
Cranberries (M)	10^{-10} to 10^{-9}
Cucumbers (M)	10^{-10} to 10^{-9}
Dewberries (FT)	10^{-8} to 10^{-7}
Eggplant (M)	10^{-11}
Grapefruit (FT)	10^{-10}
Grapes (M)	10^{-8} to 10^{-7}
Honeydew (FT)	10^{-10} to 10^{-9}
Kale (T)	10^{-8}
Leeks (T)	10^{-8}
Lemons (FT)	10^{-9}
Lettuce (M)	10^{-7}
Limes (FT)	10^{-10} to 10^{-9}
Mangoes (T)	10^{-9} to 10^{-8}
Meat (FS)	10^{-8} to 10^{-6}
Milk (FS)	10^{-6}
Mustard greens (T)	10^{-8}
Nectarines (M)	10^{-10} to 10^{-9}
Onions, dry bulb (T)	10^{-7}
Onions, green (T)	10^{-8}
Oranges (FT)	10^{-10} to 10^{-9}
Peaches (M)	10^{-7}
Peas (T)	10^{-8}
Pears (M)	10^{-9}
Peppers (M)	10^{-9}
Pimentos (M)	10^{-9}
Pineapples (T)	10^{-7}
Plums/Prunes (M)	10^{-9}
Potatoes (T)	10^{-8}
Pumpkin (T)	10^{-8}
Quince (M)	10^{-11}
Raspberries (M)	10^{-8}
Rhubarb (T)	10^{-7} to 10^{-6}
Rutabagas (T)	10^{-8} to 10^{-7}
Shallots (T)	10^{-8}
Soybeans (M)	10^{-12}
Spinach (M)	10^{-8}
Squash (FT)	10^{-9}
Strawberries (M)	10^{-7}
Tangerines (FT)	10^{-10} to 10^{-9}
Taro (T)	10^{-10}
Tomatoes (M)	10^{-8}
Turnips (T)	10^{-8}
Watermelon (T)	10^{-7} to 10^{-6}
Total risk	10^{-6} to 10^{-5}

Key: FDA monitoring data: (M); Field tests: (FT); Tolerances: (T); Feeding studies: (FS).

Approximately 33 percent of the dietary risk is due to consumption of milk. However, this calculation most likely overestimates risk from milk due to conservative assumptions used in arriving at exposure estimates.

For example, EPA uses exposure estimates based on field trial data rather than monitoring data to estimate the levels of captan in animal feed items. These data tend to maximize residue levels, as discussed below. EPA also uses conservative estimates of the

percentage of particular feed items which might be present in an animal's diet. The two main feed items which can contain captan residues are almond hulls and raisin waste. EPA assumes that up to 25 percent of an animal's diet may be almond hulls or that up to 10 percent may be raisin waste. The crops which these feed items come from are primarily limited to California. Consequently, the current estimates likely overestimate actual exposure nationwide.

EPA also believes that the estimated risk from food commodities is likely to exceed the total actual risk. As mentioned previously, either the tolerance level, field trial data or FDA monitoring data were used in estimating dietary exposure for a particular food crop. FDA monitoring data are most representative of the level to which the public is exposed because residues are measured closest to the point of purchase. However, sufficient FDA monitoring data were not available for all crops. EPA then relied on field trial data to estimate dietary exposure. These data, used by EPA in establishing tolerances, reflect the maximum registered use conditions of the pesticide (i.e. applications occur at the maximum rate and as close to harvest as the label permits). Residue levels are measured at the time the crop is harvested. Thus field trial data would overestimate actual dietary exposure because (i) residues would have time to degrade from field to market; and (ii) not all growers use the maximum number of applications or the maximum application rate. Finally, when neither sufficient FDA monitoring data nor adequate field trial data were available, EPA used the tolerance level for the commodity as the level of dietary exposure; a worst-case estimate of exposure.

In the PD 2/3, EPA expressed concern regarding the potential for reproductive effects from dietary exposure. It was noted that the dietary exposure of the average human exceeds by 63 percent the level calculated to be an acceptable daily intake (now referred to as the Reference Dose (RfD)). However, EPA stated that the final analysis of this risk would depend on residue data being required of the registrants.

Using the exposure estimates derived from the new data submitted since the time of the PD 2/3, the anticipated residue contribution represents only 1.25 percent of the RfD for the overall U.S. population and 4.1 percent for non-nursing infants which is the sub-population with the greatest exposure. Therefore, the potential for reproductive effects from dietary exposure to captan is no longer believed to present a risk of concern.

1. *Comment:* A number of comments were received regarding the dietary exposure assessment in the PD 2/3 and Technical Support Document. Stauffer Chemical Company and Chevron Chemical Company both argued that EPA had overestimated dietary exposure by basing exposure estimates on tolerance levels rather than FDA monitoring data and market basket survey data.

EPA Response: EPA noted in its PD 2/3 that risks were based on worst-case assumptions about dietary exposure and that although market basket surveys suggest exposure, and thus risk, may be substantially lower, definitive data were lacking to predict those lower risks. However, many data have been submitted since then which have allowed for a more refined dietary exposure assessment.

2. *Comment:* Stauffer and Chevron also stated that sufficient THPI data were available from which to extrapolate estimates.

EPA Response: EPA did not estimate THPI levels for the PD 2/3 because the ratios of captan levels to THPI levels in the data available were sufficiently different that EPA was unsure what ratio to use. Since that time, the Agency has requested and received actual data on residue levels of both captan and THPI in a number of raw and processed agricultural commodities. The new data indicate that THPI is an insignificant portion of the residue on raw agricultural commodities. Therefore, EPA no longer believes it necessary to estimate residues of THPI for raw agricultural commodities. THPI is included in the residue estimates for animal commodities.

3. *Comment:* The Natural Resources Defense Council, Inc. (NRDC) commented that the captan metabolite THPI was inadequately discussed in the PD 2/3. The NRDC also expressed interest in whether EPA would attempt to determine the conversion of captan to THPI that could occur through such processes as cooking or commercial food processing.

EPA Response: EPA agrees that the PD 2/3 did not adequately discuss THPI for the reason given in response to the previous comment. As previously noted, the Special Data Call-In Notice required a number of studies in order to determine the levels of captan and THPI in a variety of raw agricultural commodities, and in the same commodities following the washing, peeling, and processing steps. These data show that, while negligible amounts of THPI are present in the raw agricultural commodities, as the processing steps proceed captan is almost completely converted to THPI.

The levels of captan present on the raw agricultural commodities are now being used in our exposure assessment because they represent the upper-bounds of consumer exposure. With the exception of raisins, in all cases where data on processed commodities were available, total residues (captan plus THPI) on the items processed for human consumption were lower than captan residues on the raw agricultural commodity. (Residues are lost to washing water, peeling, cooking water, etc.)

4. *Comment:* NRDC also expressed concern regarding the adequacy of FDA's routine multi-residue analysis to detect the presence of captan.

EPA Response: EPA has used FDA monitoring whenever possible to estimate exposure. Samples collected by FDA were analyzed with a reported recovery of 80 percent for captan. The estimated limit of detection is 0.02 ppm. Consequently, EPA believes these data adequately characterize exposure to captan. While it is true that the multi-residue analytical method used by the FDA in monitoring activities detects captan but not its major metabolite THPI, this is not considered a problem because virtually all of the residue on raw agricultural products is the parent compound.

5. *Comment:* The Scientific Advisory Panel was requested to comment on EPA's "worst-case" calculation of dietary risk in the PD 2/3 and whether and to what degree EPA should use FDA's Market Basket Survey data. The SAP disagreed with the method of estimating human dietary exposure to captan. Particularly, the Panel objected to the use of tolerances, especially when FDA's Market Basket Survey data were available. It was suggested that the Survey data be used to the maximum extent possible or use alternative methods for making estimates more realistic.

EPA Response: EPA did not believe that FDA's Market Basket Survey data were appropriate in estimating captan exposure due to an inadequate number of samples. However, since the time of the PD 2/3, EPA has obtained FDA surveillance monitoring data, which encompasses a much greater number of samples of commodities than the Market Basket Survey, as well as data provided by the registrants, as discussed previously. Where the FDA monitoring data were considered sufficient (e.g., at

least 100 samples with positive detections for frequently sampled crops), EPA used these data to determine exposure levels because they are believed to be the best available data and result in a more reliable dietary exposure estimate (Ref. 16). FDA surveillance monitoring samples are not randomly chosen, but are selected partly on the basis of volume of production of a commodity, and also on the basis of prior residue problems with a particular food. Thus, residues detected in the surveillance samples probably are somewhat higher than in randomly selected samples and provide a more conservative estimate of risk. Samples are collected as close as possible to the point of production in the food chain, because the aim is to monitor fresh food being shipped in interstate commerce. This also would lead to a more conservative exposure estimate than exists when the product finally reaches the consumer. In addition, a very large number of samples from many different areas are analyzed in the surveillance program, many times more than in field trials or in FDA's Market Basket Survey. For example, 697 samples of strawberries were analyzed in 1985–1987 with 270 positive findings reported in 18 states nationwide. EPA believes that it has used the best data available in estimating exposure to captan and thus has satisfied the concerns expressed by the SAP. A more detailed discussion of the data used to estimate residues for each crop, the basis for selecting those data, and the impact the respective data set had on the calculations of dietary risk from all food uses of captan is presented in the Office of Pesticide Policy's Dietary Exposure Branch memorandum (Ref. 16).

B. Non-Dietary Exposure and Risk

1. *Initiation of Captan Special Review (RPAR).* One of the EPA's concerns in initiating a Special Review of captan was the potential oncogenic risk from non-dietary exposure to technical captan and to products containing this fungicide (45 FR 54936). At that time, no information was available on the exposure potential from non-agricultural uses of captan or exposure to home uses. EPA reviewed two studies that gave estimates of exposure to captan for mixer/loaders and applicators in orchards using airblast speed sprayers (Ref. 36) and hand held equipment (Ref. 17). EPA also expressed concern regarding the potential hazards of exposure to harvesters through reentry into fields of crops treated with captan before residues on stone and pome fruits, almonds and vegetable crops had dissipated (Ref. 17).

2. *Proposed Decision (PD 2/3).* In preparing its proposed decision on captan in 1985, EPA reviewed data submitted by registrants on non-dietary exposure to captan and products containing captan. These data were supplemented by studies in the published scientific literature and EPA's own surrogate data bank. In calculating exposure to captan EPA used a dermal absorption rate of 1.3 percent per hour. This rate was based on a study in the rate submitted by a registrant (Ref. 42) and reviewed by EPA (Ref. 61). EPA assumed 100 percent as the inhalation absorption rate (Ref. 29).

Exposure to captan was estimated by calculating the Lifetime Average Daily Dose (LADD) using the following formula: LADD = (Dose acquired in 1 working day in mg/kg/day) × (Number of days exposed per year/365) × (35 years of working/70 years lifetime). EPA quantified the oncogenic risks for various agricultural and non-agricultural uses of captan by multiplying the Ladd by the hazard potency (Q_1^*) for technical captan of 2.3×10^{-2} (mg/kg/day)$^{-1}$.

3. *Registration Standard and amendments.* EPA's PD 2/3 on captan proposed that certain protective measures and precautionary statements be required which would reduce exposure to captan to minimize the risks to workers and home users. Since EPA proposed cancellation of all food uses of captan, the protective measures were specified only for non-food uses. However, in order to protect all users while captan was in Special Review, these measures were specified for both food and non-food uses in the Captan Registration Standard issued in March, 1988 and in subsequent amendments in April 1988 and April 1987. These measures included the use of chemical resistant gloves by mixer/loaders, field workers, harvesters and home users. In addition, reentry to treated fields was not allowed within 4 days following application unless a coverall or long-sleeved shirt and long pants are worn.

The new protective measures specified in the Registration Standard were to be included on the labels on all products containing captan released for shipment after March 6, 1988. EPA considered and granted a request submitted by the Captan Task Force on June 10, 1987 to extend the dateline for relabeling existing stocks of captan pesticide products in the channels of trade by 1 year. All registrants were notified that the specified changes should appear on all labels by March 6, 1989.

C. Final Determination on Non-Dietary Exposure and Risks

As part of the Special Review process, EPA has reevaluated the exposure estimates used in calculating the risks from non-dietary exposure to captan. Information from a larger surrogate data base, developed since the PD 2/3 on captan was issued in June, 1985, and information received in response to the captan PD 2/3 have been used in this exposure analysis.

The estimated potency or Q_1^* for captan has been revised since the captan PD 2/3 was issued. The new Q_1^* is 3.0×10^{-2} (mg/kg/day)$^{-1}$ and is discussed in Unit II of this Notice. The difference in estimated potency is not sufficient to change the risk estimates for non-dietary exposure to captan presented in the PD 2/3.

Some of the comments submitted in response to EPA's PD 2/3 on captan included information or opinions regarding the accuracy of EPA's non-dietary exposure estimates and the risk assessment based on those exposure estimates. These comments and EPA's responses are summarized below in the appropriate section. Unit III.C.1. concerns agricultural uses of captan including home uses on plants and trees. Unit III.C.2. addresses exposure and risks from non-agricultural uses including use of pet products containing captan. Unit III.C.3. presents comments and EPA's responses on other issues including the use of surrogate data. In Unit III.C.4., EPA's assessment of non-dietary exposure and risk from captan are summarized.

1. *Comments and EPA response regarding exposure and risk from agricultural uses of captan.* EPA calculated the risks to agricultural applicators, mixer/loaders and field workers. The lifetime oncogenic risk to applicators ranged from to 10^{-5}. Mixer/loader risk estimates ranged from 10^{-6} to 10^{-3} except for treatment of citrus which ranged from 10^{-7} to 10^{-4}. The risk estimates for field workers were calculated using exposure data on strawberries (Ref. 1). In three studies performed in California, risks from exposure to strawberry pickers were estimated at 10^{-4}. One of these studies also estimated the risk for weeders at 10^{-3}. Later studies, also in California, showed the risk from exposure to pickers as 10^{-5} to 10^{-4} (Ref. 62) and 10^{-3} (Ref. 38). A study of strawberry pickers in Oregon showed the risk from exposure to captan as 10^{-6} (Ref. 60).

a. *Body weight estimates.* A registrant, Stauffer, questioned the apparent inconsistency of assuming that

agricultural workers weigh 70 kg while assuming that non-agricultural users weigh only 60 kg.

EPA response: This is not an inconsistency. EPA assumes that the agricultural worker is an adult male with an average standard weight of 70 kg. The average non-agricultural user of captan products is assumed to be either an adult male, adult female, or non-adult. The average weight for these individuals is assumed to be 60 kg.

b. *Exposure and risk estimates for mixer/loaders and applicators.* i. Stauffer commented that inconsistencies in calculation methods have led to erroneous estimates of upper bound risks to mixer/loaders and applicators. For example, they believe that exposure estimates are 10 to 15 times too high for air-blast applications.

EPA response: (a) *Mixer/loaders.* In estimating mixer/loader exposure to captan EPA assumed mixer/loaders wearing no gloves or protective clothing would receive an exposure of 180 mg/hr. This assumption was based on a study conducted by a registrant using captan. EPA has reviewed a surrogate study that, under similar use conditions, predicted an exposure of 47 mg/hr at a 1.0 lb a.i./acre application rate (Ref. 31). At the 2.0 lbs a.i./acre captan rate used in the PD 2/3, the Maitlen estimate would be 94 mg/hr. The two fold difference between the Maitlen based estimate of 94 mg/hr and the estimate of 180 mg/hr used in the PD 2/3 is minimal and within the range of variability observed with exposure studies. EPA finds these estimates appropriate for fruit crops (foliage and preharvest uses), vegetable crops and ornamentals. The mixer/loader exposure expressed as mg/hr would be expected to be the same for any open pour function where the application rates are the same.

(b) *Mixer/looder—Nut crops (Almonds).* In calculating exposure to mixer/loaders of captan used on nut crops, EPA relied on an exposure study (Ref. 12) which estimated exposure to mixer/loaders handling benomyl wettable powder. EPA still supports this estimate of 1.1 mg/lb (a.i.).

(c) *Airblast applicators.* The airblast applicator exposure was estimated for the PD 2/3 using the linear regression equation $y = 4.8x + 16$ where "y" is exposure in mg/hr and "x" is the application rate. This regression equation is still used by EPA and has been determined to accurately predict exposure at the application rates between 1.0 and 7.0 lbs (a.i)/acre used in the studies whose data comprise the regression equation.

(d) *Ground boom applicators.* In the PD 2/3, ground boom applicator exposure was estimated to be 24 mg/hr based on surrogate studies in which the application rates ranged from 0.23 to 3.2 lbs a.i./acre. The current generic data base used by EPA would use an exposure estimate of 9.2 to 18 mg/hr for the mean based on the application rates of 2 to 4 lbs a.i./acre used in the PD 2/3. There is no meaningful difference between the estimate of 24 mg/hr used in the PD 2/3 and the 9.2 to 18 mg/hr exposure rate estimated from the current data base especially when considering the two orders of magnitude variation in exposure observed with ground boom application. Great variability in exposure is expected due to differences in equipment used, weather conditions, and personal work habits that occur both between applications and applicators.

(e) *Pilot exposure.* In the PD 2/3, pilot exposure was estimated to be 2.3 mg/hr based on application rates of 2.5 to 6.0 lbs a.i./acre (Ref. 28). Using its current generic data base EPA estimated pilot exposure to be 0.58 mg/hr at an application rate of 1.0 lb a.i./acre.

At the higher application rates of 2.5 to 6.0 lbs a.i./acre used in the earlier study, the estimated exposure would be 1.5 to 3.5 mg/hr. This figure encompasses the estimate used in the PD 2/3 which is still supported by EPA. EPA also supports its previous estimate that the risk to pilots applying captan to almonds is 10^{-7}.

ii. A registrant, Chevron Chemical Company, while agreeing with EPA's position that it is prudent for those mixer/loaders in contact with captan to wear a dust mask and gloves, commented that inhalation exposure during application of captan is 100 times less than that during mixing and loading. They stated that EPA's suggested requirement that a dust mask be worn during application would not significantly reduce exposure particularly since captan in not applied as a dust.

EPA response: Since the PD 2/3 was issued in June, 1985, EPA has modified the protective clothing requirements for persons exposed to captan. Dust masks were not specified in the Registration Standard since inhalation exposure is negligible compared to dermal exposure. EPA still recommends, in accordance with good industry practices, the use of dust masks for mixer/loaders handling dusty formulations. All mixer/loaders and applicators should wear coveralls, goggles or face shield, chemical resistant gloves, and boots or overshoes. In addition, a chemical resistant apron should be worn during mixing/loading. A hat or other appropriate head covering should be used for overhead application in which spray is expected to fall down toward the head.

Chevron also disagreed with EPA's assessment that mixer/loaders and those who apply captan to cranberries face an inhalation hazard that is not typical of other crops.

EPA response: Tables 10 and 11 in the PD 2/3 on captan show the dermal and inhalation exposure estimates used in calculating risks to mixer/loaders and applicators respectively. The inhalation exposure estimates for cranberries are the same as those for almost all fruits. EPA acknowledges that the use of cranberries alone as an example of a site involving both dermal and inhalation exposure to captan was confusing (PD 2/3 B-94).

iii. The University of Hawaii at Manoa submitted comments on the use of captan on wetland taro. They noted that worker exposure, if of concern, would only be relevant to the actual applicator, and could be minimized, if necessary, by revised directions for use. They stated that since the application of captan in made only once per growth cycle, which is 12 to 15 months from planting to harvest, with the application being a direct soil application with incorporation, and since the average taro farm is 2.38 acres with a State total of 370 acres (1983), even applicator exposure poses minimum risk.

EPA response: EPA agrees that workers applying captan to taro have comparatively little exposure to captan compared, for example, to applicators making foliar applications to other crops. However, although only a low level of exposure is involved in this captan use, EPA believes that all applicators should use chemical resistant gloves and coveralls, as specified in the Registration Standard, since they provide an important minimal level of protection for all applicators for agricultural uses of captan.

c. *Field worker and harvester exposure and risk estimates.* i. The California Almond Growers Exchange and Chevron Chemical Company noted that almond culture is highly mechanized and that workers have little contact with foliage or the crop.

EPA response: EPA acknowledges that almond culture is highly mechanized and that workers have little contact with foliage or the crop. However, in the absence of adequate exposure data, EPA still supports its initial estimate of exposure during the procedures involved.

ii. The California Prune Raisin and Walnut Research organization and Chevon Chemical Company commented that the fieldworker exposure estimates

for strawberries are not applicable to prunes and raisins since applications occur several months prior to harvest, and that potential exposure during application can be reduced to acceptable levels with protective gloves and face masks.

EPA response: EPA agrees that the strawberry data are not applicable to prunes and raisins and will reevaluate fieldworker exposure to prunes and raisins when new data on tree fruit crops and grapes have been received and reviewed.

iii. The Florida Strawberry Growers Association commented that the use of water resistant gloves during harvest is impractical as they would cause damage to the fruit. They also suggested that irrigation prior to harvest would eliminate crop residues.

EPA response: EPA has reviewed a study conducted by the California Department of Food and Agriculture on the use of captan on strawberries. This study found that all of the women (but less than 5 percent of men) normally wear chemical resistant gloves to protect their hands from dirt and strawberry juice. Unless Florida varieties vary so significantly from California varieties of strawberries, EPA does not believe that gloves will be any less practical in Florida than has been demonstrated by female harvesters in California. In regard to the suggestion that irrigation prior to harvest would reduce exposure to harvesters, EPA has no evidence, and no data have been received from registrants, to show that irrigation reduces captan residues and removes the need for protective gloves.

iv. A registrant, Chevron, commented that EPA has seriously overestimated exposure to fieldworkers. They questioned the validity of EPA's use of monitoring data from field workers who were wearing cotton gloves to pick strawberries treated with captan. They referenced a study which showed that exposures obtained by using cotton gloves were approximately five times larger than those obtained by using hand rinses.

EPA response: While it is true that cotton gloves may overestimate hand exposure in some field studies, it is also possible that they may underestimate exposure in others, depending upon how long gloves are worn during the monitoring period, type of work activity, type of formulated product, chemical, etc. It has not been demonstrated for captan that cotton gloves overestimate or underestimate exposure as compared to hand rinses, which are generally believed to underestimate exposure, nor has it been demonstrated for either methodology that they accurately simulate the retentive properties of human skin. The pros and cons of hand exposure passive dosimetry are discussed in depth in Subdivision U of EPA's Applicator Exposure Monitoring Guidelines (Refs. 30 and 59).

v. Chevron also stated that they found it neither scientifically nor statistically valid to extrapolate data from strawberry weeders to all fieldworker exposures. They found the study on weeders unsound, noting that the data on exposure was gathered using four children ages 8–13 and that the range of exposures for the four subjects was extreme: from 3.91 mg/hr to 266.72 mg/hr.

EPA response: EPA agrees that it is not valid to extrapolate fieldworker exposure from strawberries to other crops. EPA will reevaluate fieldworker exposure once the additional data are received.

d. *Seed Treatments.* The National Cotton Council commented that captan is applied to cotton almost exclusively by commercial seed treating companies. They expressed the view that protective gloves should be required for those handling seed, and not for harvesters or field workers.

EPA response: EPA agrees that chemical resistant gloves should be worn by workers involved in handling treated seed (commercial/bulk manual mixing of captan during seed treatment and hopper filling). Reentry intervals and protective clothing requirements would not be imposed for cotton field workers or harvesters when captan is only used as a preplant treatment on cotton seed because EPA believes there would be very little, if any, residues on the plant. Consequently, exposure would be minimal and a reentry interval would be unnecessary.

e. *Home garden uses.* In regard to the estimates of risk from home use of captan, EPA received one comment from Security Lawn and Garden Products that EPA has overestimated exposure to the home user when captan is used for spraying trees. In their estimate, it takes only 45 minutes per 6 trees using a hose-end applicator to mix, apply, and clean up.

EPA response: EPA estimate was that the home user would be exposed for 1.25 hours. EPA finds that even if the lower estimate suggested by Security Lawn and Garden were used, it does not make an appreciable difference to the risk from this use of captan. The estimated risk using the higher exposure estimate is 10^{-7}.

2. *Comments and Agency response regarding the non-agricultural uses of captan.* The risks for non-agricultural uses of captan were described in detail in the PD 2/3. These risks ranged from 10^{-4} to negligible. For example, the estimated risks from exposure to animal shampoos containing captan ranged from 10^{-5} to 10^{-4}. Risks for workers incorporating captan into plastics, paints and cosmetics were estimated as negligible, and as 10^{-5} for adhesives. EPA calculated that exposure to workers cutting and packaging cut flowers treated with captan results in risks of 10^{-7} to 10^{-6}.

These risks from non-dietary exposure to captan are described in detail in the Captan PD 2/3. All risks were calculated at the 95 percent confidence level and reflect the upper limit of excess cancer risk which is not likely to be exceeded.

Some estimates of exposure and risk from non-agricultural uses of captan have been evaluated in light of additional data and comments received in response to EPA's PD 2/3 on captan. These data and comments are summarized below with EPA's response.

a. *Adhesives.* Stauffer questioned the accuracy of EPA's exposure assessment for adhesives believing them to be exaggerated.

EPA response: The risk estimate for mixer/loader/applicators of captan to adhesives was estimated in the PD 2/3 to be 10^{-5}. However, EPA has since considered that because captan is added to the adhesives via a feeding system and that common industry practice is such that there is very little human exposure during this process. In light of this additional information the estimate of risk to these workers has been reduced to "negligible."

b. *Non-agricultural home uses.* i. Stauffer questioned the consistency of EPA's assumption that all of the captan available in shampoos and pet powders is 100 percent absorbed. Stauffer estimated that the absorption rate for powders would be less than 100 percent.

EPA response: The use of a 100 percent dermal absorption rate in the PD 2/3 calculations for both pet shampoos and pet powders was inconsistent. Absorption from shampoos is calculated at 100 percent because of the solvents and emollients in the shampoo. The estimated risk from exposure to pet shampoos containing captan (without chemical resistant gloves) remains at 10^{-6} to 10^{-4}. Dermal absorption for pet powders has been recalculated at 1.3 percent which reduces the risk from exposure to pet powders from 10^{-9} to 10^{-10}.

EPA's estimate of exposure to captan in pet shampoos remains at 100 percent because exposure is to an oil/water emulsion, with glycerine, or triethanolamine stearic acid soap. EPA's

estimate of risk from exposure to captan in pet shampoo is 10^{-5} to 10^{-4} without gloves. The use of chemical resistant gloves specified in the Registration Standard, and subsequent amendments, would reduce the estimated risk from captan in pet shampoos to 10^{-6} to 10^{-5}. The registrant for the remaining registration for pet shampoo containing captan requested a voluntary cancellation of this product in January, 1988.

ii. A comment was received from the Natural Resources Defense Council and California Rural Legal Assistance Foundation (NRDC/CRLAF) in response to the PD 2/3 regarding cosmetics. NRDC/CRLAF expressed the view that EPA had not demonstrated sufficient concern regarding the potential risk posed by the use of captan in these products; that EPA had not informed the Food and Drug Administration (FDA) of the risk in a timely manner; and that EPA had not requested that the FDA notify consumers of all cosmetic products containing captan.

EPA response: EPA agrees that it is important that EPA should release information to other agencies in a timely manner when risk data on ingredients which are also regulated by other agencies becomes available. EPA did forward to FDA the information available regarding the risk from exposure to captan in cosmetics, even though EPA did not have sufficient data to warrant a recommendation to the FDA that the public be notified immediately of the potential risk posed by captan.

Since the PD 2/3 was issued, the FDA has continued to evaluate the potential risk from exposure to captan which is used as a bacteriostat in cosmetics and as an active ingredient in medicated shampoos. A recent report prepared for FDA by the Expert Panel of the Cosmetic Ingredient Review concluded that the available data are insufficient for the FDA to determine whether captan, under each relevant condition of cosmetic use, is either safe or not safe and recommended that the FDA undertake the collection of additional data on the potential for skin carcinogenicity (Ref. 11).

3. *Other comments and EPA's response on the preliminary determination on non-dietary exposure and risk*—a. *Teratogenic and reproductive effects.* NRDC/CRLAF expressed their concern that the teratogenic and reproductive toxicity for workers was neither discussed nor calculated in the PD 2/3. They expressed their concern that workers are more likely to be at teratogenic risk than consumers of captan treated food.

EPA response: EPA has received additional data on the teratogenic and reproductive effects of captan and these effects are no longer considered to be at a level of concern. These issues are discussed in Unit II of this Notice.

b. *Use of surrogate data.* The NRDC/CRLAF commented that for several use sites, EPA relied on exposure studies conducted for other chemicals in determining captan exposure without providing any justification for reliance on this surrogate data. For example, for not crops, an exposure study for benomyl was used as a surrogate for exposure to captan.

EPA response: EPA believes that the use of surrogate data to estimate the exposure to individuals handling a pesticide has become an accepted procedure in the scientific community. As one would expect, a large array of variables affect the exposure received by a mixer/loader or applicator. The factors that impart the greatest impact to which the data can be normalized are formulation type, application rate, acreage treated, clothing and equipment used. Other factors that have an impact on exposure, for which standardization of variation is difficult, are environmental conditions and personal work habits. Chemical specificity is very important in determining dosage, which depends on the ability of the specific pesticide and formulation to penetrate the skin. EPA's Pesticide Assessment Guidelines, Subdivision U, discusses the issue of surrogate data in more detail. Current Agency policy is to use appropriate surrogate data in estimating exposure when adequate chemical specific data are not available; when chemical specific data become available, they are incorporated into the data base. A large data base is more important in that it assists EPA in estimating the wide range of possible exposures believed likely to occur for a pesticide during its use on any given use site.

c. *Use of protective clothing.* The NRDC/CRLAF expressed concern that EPA consistently estimates that protective clothing and rubber gloves will reduce exposure to pesticides by about 80 percent. They stated that the assumption was made throughout the PD 2/3 that there would be a reduction in dermal exposure to captan resulting from the use of protective clothing but that this assumption was not documented. They asked if any captan exposure studies had been conducted to support these percentage reductions and challenged the validity of these estimates in the absence of chemical-specific data.

EPA response: EPA's Applicator Exposure Monitoring Guidelines, Subdivision U (NTIS Document No. PB87-133286), discusses estimating the protective value of clothing. There is not sufficient data available to identify a single statistically valid value for clothing penetration. In EPA's surrogate data base, there is a clustering of values in the 5 to 10 percent range, which suggests that level may be typical. Thus, for a chronic exposure, where average exposure is important, a 10 percent penetration (or 90 percent protection) estimate is appropriate. However, in the surrogate data base, there are sufficient excursions above the 5 to 10 percent level to demonstrate that, on occasion, exposures are much higher. For an acute effect, it is important to consider exposure which could occur on any given day. Thus, EPA saw the need to create a safety factor above the 10 percent penetration estimate for acute effects. A 50 percent estimate was chosen because it incorporates an ample safety factor over the 5 to 10 percent estimate and includes many of the outlying excursions representing higher penetrations as well. Because captan's toxicological concern is based on chronic exposure rather than single dose (acute) exposure, the 10 percent penetration, or 90 percent protection, estimate was used.

d. *Home uses of captan.* NRDC/CRLAF were critical of EPA for not stating its position regarding home use of captan. They urged EPA to immediately suspend home use of captan given the oncogenic, reproductive, and possible teratogenic and mutagenic concerns associated with this chemical. They expressed the opinion that although EPA could argue that protective clothing would substantially reduce the risks from inhalation and dermal exposure, it was unlikely that home gardeners would adhere to such label precautions or that they would have proper protective clothing available. NRDC also requested that subsequent Agency Special Review documents on captan, or any other chemical, contain a distinct section identifying the risks and benefits of the home uses and the regulatory decisions on such uses.

EPA response: The oncogenic risks for home uses of captan on plants and gardens were estimated in the PD 2/3 to be 10^{-7}. This estimate is confirmed by a study in which home user application was measured directly. The exposure estimate assumes that a short-sleeved shirt and long pants are worn; it does not assume the use of any protective equipment, including gloves (Ref. 27).

EPA has recommended the use of protective gloves and that labels of captan products for home use list simple instructions geared towards the home uses that would result in a further reduction in exposure if they were followed. EPA agrees with NRDC/CRLAF that position documents on pesticides which are labelled for home use should clearly describe the risks and benefits of these uses.

4. *Summary of EPA's assessment of the risks from non-dietary exposure to captan.* Based on the review of the available data and the comments received in response to the PD 2/3 regarding risks from non-dietary exposure to captan, EPA has determined that the exposure and risk estimates for mixer/loaders and applicators have not changed substantially (Table 3). The highest risks remain in the range of 10^{-6} to 10^{-5}.

TABLE 3—PD 2/3 RISK ESTIMATES (WITHOUT PROTECTIVE CLOTHING) [1]

Agricultural uses	Mixer/loader	Applicators
Fruit/nut crops:		
Almonds	10^{-6} to 10^{-5}	10^{-5} (aerial)
Apples:		
Preharvest	10^{-6}	10^{-6} to 10^{-5}
Postharvest	10^{-6}	
Apricots	10^{-6}	10^{-6}
Avocados	10^{-6}	10^{-6}
Blackberry	10^{-6}	10^{-6}
Blueberry	10^{-6} to 10^{-5}	10^{-6}
Cherries:		
Preharvest	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}
Citrus	10^{-7} to 10^{-6}	10^{-7} to 10^{-6}
Cranberry	10^{-6}	10^{-6}
Grapes	10^{-6}	10^{-6}
Mangos	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}
Nectarines	10^{-6}	10^{-6}
Peaches	10^{-6}	10^{-6}
Pears	10^{-6}	10^{-7} to 10^{-6}
Plums	10^{-6}	10^{-6}
Pineapple	10^{-7}	10^{-7} to 10^{-6}
Strawberry	10^{-6}	
Vegetable crops:		
Beans	10^{-6}	10^{-6}
Beets	10^{-6}	10^{-6}
Carrots	10^{-6}	10^{-6}
Celery	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}
Cucurbits	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}
Eggplant	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}
Lettuce	10^{-6}	10^{-6}
Peppers	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}
Potatoes:		
Foliar	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}
Seed treatment	10^{-7} to 10^{-6}	10^{-7}
Rhubarb	10^{-6} to 10^{-5}	10^{-7} to 10^{-6}
Soybeans:		
Seed treatment	10^{-7} to 10^{-6}	10^{-7} to 10^{-6}
Spinach	10^{-6}	10^{-6}
Sweetcorn	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}
Taro		
Tomatoes	10^{-6} to 10^{-5}	10^{-6} to 10^{-5}

[1] These risk estimates are summarized from the exposure and risk estimates presented and discussed in Unit II. of the PD 2/3. This PD 4 supports the same risk conclusions.

[2] The Agency estimates that the risks for mixer/loaders and applicators are reduced by between 80 and 90 percent when protective clothing is used. Typically data are reduced by an order of magnitude, for example, from 10^{-7} to 10^{-6}. (See text in Unit III. for more details.)

EPA believes it is appropriate to assume, for chemicals with chronic concerns including oncogenicity, that the type of protective clothing proposed in the Captan PD 2/3 and contained in the Captan Registration Standard and amendments protects covered areas by reducing exposure to this area by 90 percent.

The estimate of risk for applicators from exposure to captan incorporated in adhesives has been reduced from 10^{-6} to "negligible". The home user's risk from exposure to captan in products used on plants and gardens is 10^{-7}.

EPA has not changed its earlier estimates of fieldworker/ harvester risks from non-dietary exposure to captan. Risks were calculated to be at 10^{-6}. Additional data on fieldworker/ harvester exposure have recently been submitted to EPA as part of the data required by the Registration Standard. When these data submissions have been completed and reviewed EPA will reevaluate the risks to fieldworkers/ harvesters from exposure to captan and establish appropriate reentry periods.

In EPA's PD 2/3 on captan, EPA proposed certain protective clothing requirements which it was anticipated would reduce the non-dietary exposure to captan for mixer/loaders, applicators, fieldworkers, and home users. For agricultural uses of captan, a reentry interval of four days was specified replacing the former requirement that workers must not enter captan treated fields until after sprays had dried. These measures were also specified in the Captan Registration Standard and subsequent amendments and included labelling changes reflecting EPA's policies regarding protective clothing and other precautionary measures. Unit VI of this Notice states EPA's conclusions regarding the worker risks from the use of captan.

IV. Summary of Benefits Assessment and Agency Evaluation of Comments and Additional Data Received

In its PD 2/3, EPA presented an analysis of the benefits associated with the continued use of the fungicide captan, and presented a crop by crop evaluation of the benefit considerations in an accompanying Technical Support Document. The benefits of captan were assessed in terms of the economic impacts which would result for producers and consumers if the chemical were no longer available due to cancellation. The main factors considered in the impact analysis were changes in production costs and crop yields.

An assessment of the effects of cancelling captan provides a baseline estimate of the value of captan products to the agricultural community and society, and illustrates the effects that would follow if captan users had to switch to alternative fungicides.

In issuing the PD 2/3 EPA expressed its concern not only with risks from the use of captan but with the risks associated with fungicides as a group. EPA was aware that the proposed cancellation of the food uses of captan might result in growers shifting to alternative chemicals that also had toxicological concerns. While proposing to examine each of the alternative fungicides through the Registration Standard or Special Review process, EPA encouraged registrants to generate data on safer and less toxic chemicals and alternative methods of controlling fungi. EPA's current assessment of the likely shifts in usage for various cancellation scenarios involving captan, chlorothalonil and the EBDCs is discussed in Unit VI of this Notice.

The importance EPA has placed on considering the fungicides as a group is also based on its concern that estimates of the benefits of any one fungicide need to take into consideration the problem of resistance. Research on the efficacy of various fungicides shows that resistant strains of fungi may develop when only one, or in some cases when a limited number of different fungicides is used. If resistance develops and no alternatives are available, major economic losses could occur if control of the pest or pathogen is essential to crop production. It is difficult to predict if and when resistance will develop for every use site due to variability in fungal populations, climatic variations in different regions, and variations in the combination of fungicides used by different growers. Resistance is more likely to develop when there is heavy disease pressure over an extended portion of the growing season. EPA has taken this problem of resistance into consideration in its benefits analysis for each of the registered uses of captan.

In the PD 2/3 and the Technical Support Document for captan, EPA estimated that the proposed cancellation of captan on all food crops would result in total first year losses to farmers of $20 to $66 million (including seed treatments), which represents the increased costs of using, in some cases, more expensive alternative fungicides and the decreased value of production (decreased yields). It was estimated that the burden would be borne largely by

the consumer for fruit and vegetables, by the farmer for seed treatments and by the grower for ornamentals. EPA did not propose cancellation of the non-food or nonagricultural uses of captan. Seed treatments were considered a food use, but were not proposed for cancellation in the PD 2/3.

In response to the PD 2/3 issued in June, 1985, EPA received numerous comments relating to its assessment of the benefits of captan and the potential economic impacts of its cancellation.

The following registrants submitted preliminary comments including benefits and usage information to EPA in August, 1985: Chevron Chemical Company, Inc., Stauffer Chemical Company, Inc., and Makhteshim-Agan (America), Inc. A more extensive benefits summary of apples, strawberries, stone fruits and seed treatments was conducted for the registrants by SRI International and submitted to EPA in March, 1986. In October, 1988, the industry's Captan Task Force, now under the direction of ICI Americas, Inc., submitted a draft of their most recent captan benefit assessment (Ref. 21). This assessment addressed the use of captan on the following crops: almonds, apples, apricots, blueberries, caneberries, cantaloupes, cherries, cucumbers, grapes, nectarines, peaches, tomatoes, pears, plums, prunes, strawberries; the post-harvest treatment of apples, cherries and pears; and a number of seed treatments. The Task Force has submitted the required residue data in support of the continued registration of the following food uses of captan: almonds, apples, apricots, cantaloupe, cherries, cucumbers, grapes, nectarines, peaches, pears, plums/prunes, strawberries and tomatoes.

The U.S. Department of Agriculture (USDA) submitted comments in response to EPA's Preliminary Determination on captan. The USDA is conducting an in depth assessment of all chemical fungicides, including captan. They believe that there are significant benefits to having captan available for some minor uses which registrants have not supported, and may undertake to gather data for some of these uses. It is anticipated that the results of their fungicide assessment will become available in 1990. The USDA comments appear in their entirety in Unit V of this document.

Comments on the benefits of captan were also received from 9 individual growers or processors, from 12 grower associations, and from Cooperative Extension Services or university research facilities in California, Georgia, Louisiana, Ohio and Washington.

Many responses stressed the established record of effective captan use including low cost, relative ease of use and low phytotoxicity. It was also emphasized that captan is effective against a broader spectrum of diseases than many of its alternatives. Many rebuttals to EPA's proposed cancellation of the food uses of captan expressed the opinion that its removal from the marketplace would have a detrimental effect on the production of fruit crops and almonds, and on the post-harvest treatment of tree fruits. It should be noted that very few of the rebuttals included any new field data, technical literature, or experimental data to substantiate the various benefits statements submitted.

A. Food Uses of Captan

As a result of concerns raised by commenters and the additional data that have become available, EPA has revised its estimates of the economic impacts relating to the use of captan on a number of food crops. For example, EPA now estimates that if captan were not available as a post-harvest treatment on cherries or pears, annual losses would amount to $4.6 and $16.3 million respectively.

In the PD 2/3, the total estimated benefits for the registered food uses of captan (excluding seed treatments) were between $11.3 and $23.7 million per year. EPA agrees with Extension Service and state recommendations that on some crops there are no viable alternatives to captan when certain diseases are present and also finds that captan is important in slowing the development of resistance to its alternatives. These are important although unquantified benefits of having captan available. EPA now estimates the quantifiable economic benefits of having captan available for the food uses of captan (excluding seed treatments) to be at least between $67.8 and $75.1 million dollars annually.

The following sections give EPA's estimats of the likely impacts that would result from the loss of captan's availability for disease control on each of the crops for which it is currently registered.

1. *Almonds.* In EPA's preliminary determination on the benefits of retaining the use of captan on almonds, it was estimated that captan was used on about 188,000 acres of almonds, representing about 50 percent of U.S. almond acreage with annual benefits of about $1.4 million. Comments from the Almond Board of California in 1985 indicated that EPA's 1979 data underestimated the total almond bearing acreage, and that 50 percent of the total acreage is 233,000 acres. Information from industry's Captan Task Force in October, 1988 noted that extension experts estimate that between 75 and 100 percent of all almond acreage is treated with captan.

Comments received about the efficacy of captan in treating diseases on almonds include the California Almond Growers Exchange's assessment that captan is the most useful protectant fungicide for almonds because it is effective against the four major diseases attacking blossoms, leaves and buds. Also, in the San Joaquin Valley where most of California's almond production occurs, dry conditions make it possible for growers to control both brown rot and shot-hole with a single fungicide application. Captan's broad spectrum of efficacy makes it particularly useful for this kind of application. Knowledge of the brown rot benomyl resistance on peaches can be used effectively in directing the use of broad spectrum alternatives to delay similar resistance problems in other crops. Captan would provide a valuable alternative to benomyl in the event that almond brown rot became resistant to this chemical.

Conclusion: EPA agrees that total almond bearing acreage has increased significantly since 1979 and that captan use has also increased. However, EPA maintains its position that about 60 percent of the almond acreage is treated with captan. Captan's use is important in slowing the development of resistance. Some resistance to the alternatives benomyl and iprodione which are used in treating brown rot has already been reported. Captan and ziram are the only two products that currently give effective control of shot-hole which is another major disease on almonds. Captan is preferred to ziram because it also controls brown rot, leaf blight and scab, resulting in fewer applications and reduced treatment costs.

EPA agrees that captan is the only registered fungicide which controls all the major almond diseases and thus does not require two or more fungicides to cover the entire spectrum of diseases. Its broad spectrum activity also makes it the preferred pesticide to be used in combination with benzimidazoles (benomyl and thiophanate-methyl), and with the new sterol biosynthesis-inhibiting fungicides where it is used to prevent or ameliorate resistance build-up in pathogenic fungi. Benefits have increased by at least the 24 percent increase in acres to about $1.7 million per year.

2. *Apples.* The use of captan is registered both as a pre- and post-

harvest treatment on apples. In the PD 2/3, EPA estimated the loss in net revenues to farmers if the pre-harvest uses of captan on apples were cancelled. The effect of cancellation of the post-harvest use on apples was not estimated. Average annual per acre losses ranged from approximately $530 in the Northeast to $250 in the Southeast. It was also anticipated that the loss of captan would result in the diversion of about 40 million pounds of fresh fruit annually to the processed market because of the likely increase in disease damage when alternatives to captan were used.

EPA's position was that although none of the captan alternatives were registered for control of all the apple diseases that can be controlled by captan, there were viable alternative fungicides. Dikar®, containing mancozeb and dinocap, was mentioned as one of the most effective alternatives to captan. Others included metiram, captafol and folpet. Two of these alternatives: folpet and captafol, have since been 709 cancelled. Mancozeb and metiram (EBDCs) are currently in Special Review.

A plant pathologist with the Cooperative Extension Service at the University of Georgia commented that captan has been a major fungicide for controlling fruit disease, particularly on apples, for about 25 years and that fruit growers in Georgia would lose millions of dollars if captan were not available to control the summer rots that affect apples.

Comments received from the Cooperative Extension Service, Washington State University, stressed the importance of the post-harvest treatment of apples. The Captan Task Force also addressed the need for captan in post-harvest treatment of apple diseases. They estimate that in the Northwest as much as 50 percent of the apple production (almost 430,000 tons of apples) that is currently treated with captan would be lost.

In Washington State, a 17 percent loss would result in a loss of about $54 million. This estimate is based on the inability of the benzimidazoles and other non-EBDC alternatives to captan to control the same broad spectrum of pathogens. The Captan Task Force predicted similar losses in Wisconsin due to resistant Penicillium blue mold strains which would result in annual losses estimated at about one-quarter of a million dollars.

In New York, an estimated 10 percent of the apple crop would be lost without captan. Extension experts indicate that packing houses would use a combination of diphenylamine, which is more expensive than captan, and a benzimidazole. Losses in this state could total $8 million annually.

Virginia packing houses are not expected to use diphenylamine as it has been found to cause injury to Golden Delicious apples in field trials. It is estimated that up to 25 percent of the Virginia apple crop would be destroyed without captan due to resistant strains of Botrytis and Penicillium, resulting in an annual loss of almost $5 million. The Captan Task Force stated that without captan, the total loss to apple producing states would be approximately $72 million per year.

The most recent information received from registrants through the Captan Task Force (October, 1988) includes their estimate that approximately 57 percent of all apple acreage is treated with captan which is somewhat higher than the original Agency estimate of 35 percent.

Conclusion: Comments received indicate that about 50 percent of the apple acreage may be treated with captan; however, data were not submitted to support this claim. Therefore, EPA retains its estimate of the net impacts due to the loss of captan for pre-harvest uses as discussed in the documents supporting the PD 2/3. EPA recognizes that particular regions may experience high losses if captan were not available.

Although EPA did not estimate the impact of the loss of captan as a post-harvest treatment in its PD 2/3, EPA agrees with estimates received in comments that about 25 percent of the apple crop is treated with captan post-harvest. While EPA has not put a specific dollar estimate on the magnitude of benefits of post-harvest captan treatments, the loss of captan could result in losses in excess of $25 million if only 5 percent of the apples in storage were lost due to storage rots.

3. *Apricots.* In its PD 2/3, EPA stated that there was unlikely to be widespread decreased disease control if captan were not available. It was estimated that about 15 percent of apricot acreage is treated and that the economic impact of the loss of captan was estimated to range from a decrease in control costs of $634,000 to an increase of $760,800 depending on the alternative selected. It appeared that the most likely alternatives to captan were thiophanate methyl, triforine, maneb, benomyl, and sulfur.

EPA's current estimate is that approximately 60 percent of the apricot crop in the United States is treated with captan. The recommended alternatives to captan include ziram, maneb, zineb, benomyl, iprodione, triforine, sulfur and thiophanatemethyl.

The Captan Task Force summary of the economic impact of captan on this crop indicates that ziram is the only alternative and that ziram is both more expensive and less effective than captan. As with other crops, there is concern by growers that more than one chemical should be available so that the problem of fungal resistance can be minimized.

Conclusion: Although EPA believes there are other alternatives to captan besides ziram for some diseases, EPA agrees with the Task Force summary in reference to the resistance problem. The EBDCs are in Special Review and if their use on apricots were cancelled captan would be even more important for deterring the build-up of resistance with the newer biochemically selective fungicides.

4. *Caneberries/blueberries.* In 1988, EPA estimated that captan was used for disease control on about 25 to 35 percent of caneberries (blackberries, dewberries, and raspberries), blueberries and cranberries. It was believed that major losses of $3.5 to $4 million would occur for those producers using captan due to increased treatment costs of $280,000 to $300,000 and production losses of $3.3 to $3.7 million.

The North American Blueberry Council is gathering residue data in support of the continued registration of captan on blueberries. In telephone communication with EPA, they indicated that captan is used to treat 90 percent of the 14,000 acres that are currently in production in Michigan where it is applied two or three times a year. New Jersey has 9,500 acres of blueberries which are treated with captan twice a year. Captan is used in mixes or alternated with sterol inhibitors (e.g. triforine) as an anti-resistance measure. The Council expressed their concern that the loss of captan would have a major impact on producers and consumers of this crop.

EPA also received information from the USDA which indicates that blueberry acreage in Illinois, Massachusetts and Washington is also treated with captan.

The Captan Task Force submitted some information on blueberries which indicated that no effective alternatives exist to control most of the diseases on this crop. Captafol is no longer registered, and resistance to benomyl has made it ineffective for Botrytis control. The Task Force estimates that by the second or third year that captan is unavailable, growers would lose

anywhere between 20 and 40 percent of their fruit revenues.

The Captan Task Force commented that approximately 40 percent of all caneberry acreage is treated with captan and that if this fungicide were not available the cost of disease protection would increase significantly because of the higher cost of the alternatives. The most likely alternative treatments would be three applications of an iprodione and benomyl combination followed by one or two applications of benomyl alone. They note that some resistance to these alternative chemicals has already occurred.

Several comments were received from caneberry growers and processors and their associations. They indicated that captan is effective against Botrytis and fruit rot to which small fruits are susceptible particularly during a rainy season and noted that Botrytis has shown no resistance to this fungicide.

A member of the Department of Plant Pathology at Ohio State University also expressed concern about EPA's proposed cancellation of captan. He described captan as the most commonly used and effective fungicide on small fruits and that there are not sufficient alternative fungicides to replace the use of captan in small fruit production.

One estimate of the use of captan on dewberries is that 40 percent of the crop is treated annually. Texas also recommends captan for control of anthracnose, fruit rot and Phomopsis on these small berries. The alternatives are copper hydroxide, or combinations of maneb and zinc or copper sulfate, sulfur, zineb and maneb.

Conclusion: While it remains difficult to get information on all of the minor berry crops, EPA believes that between 25 and 40 percent of blueberries and caneberries are treated with captan. While the various comments received claim losses for specific problems, none of the responses received aggregate the impacts to provide any information which would indicate that EPA's initial benefit estimates were incorrect. Therefore, EPA is not changing its position that annual losses of $3.5 to $4 million will occur if captan uses were cancelled on these sites.

5. *Cantaloupe/Muskmelons.* In the PD 2/3, EPA did not discuss the use of captan on cantaloupe/muskmelons and had no information available to indicate that captan was important for disease control on this crop. Since the PD 2/3, industry's Captan Task Force has submitted information indicating that there is very little use of captan on cantaloupe/muskmelons and that there are more efficacious alternatives available.

Conclusion: EPA believes that less than 10 percent of cantaloupe/muskmelons are treated with captan and that there are adequate and probably more efficacious alternatives to captan for this crop including triadimefon, benomyl, chlorothalonil, mancozeb, maneb and zineb.

6. *Celery.* EPA did not directly address the benefits of captan use on celery in the PD 2/3 but instead addressed vegetables as a group since EPA had little data and no indication that captan had important benefits on these crops.

Comments received provided conflicting information on the percent of celery which is treated with captan. One estimate indicates that 70 percent of this crop is treated with captan, while other estimates state that 1 percent or less is treated annually. Florida recommends captan as a plant bed drench or spray to control damping-off and this appears to be a use for which few, if any, alternatives are available. The alternatives for foliar treatment of celery diseases appear to be adequate and include benomyl, chlorothalonil, coppers, mancozeb, metiram, maneb, thiophanate-methyl, DCNA and thiram.

Conclusion: EPA concludes that captan is not important as a foliar treatment for celery. However, it agrees that the plantbed treatment for Florida celery represents an important use in that state and that the loss of this treatment could result in a total loss of the crop when damping-off presents a problem. EPA estimates that a loss of 10 percent of the crop in Florida would result in losses of about $4.6 million.

7. *Cherries.* In the PD 2/3, there was insufficient information available to estimate the benefits impact of the cancellation of captan uses on cherries; however, EPA had no reason to believe that producers would experience major losses.

Comments submitted to EPA by the Ortho-Chevron Chemical Company in 1985 stated that resistance to alternatives such as thiophanate-methyl had already occurred on sweet cherries. In addition, the Captan Task Force's 1988 assessment of captan usage on this crop states that although the efficacy and comparative performance of alternatives is estimated to be equal to captan, without captan the costs of disease management would increase significantly. Alternatives include: iprodione, vinclozolin and chlorothalonil for brown rot; iprodione for Botrytis; dodine on tart cherries and ferbam on sweet cherries for leaf spot. The Task Force estimates that approximately 80 percent of sweet and 5 to 10 percent of tart cherry acreage is treated with captan annually. Three of the five chemicals listed as alternatives to captan should be used alternately or in combination with captan or another broad spectrum fungicide to inhibit resistance development. The only other broad spectrum fungicide registered on cherries is chlorothalonil.

Registrants also regard captan as an important post-harvest treatment on sweet cherries. The Captan Task Force estimates that the total loss of revenue on this crop would be almost $16 million if captan were not available. Washington ($7 million) and Oregon ($8 million) would be the most affected. Alternatives to captan include the benzimidazoles. However these alternatives are considered less effective overall because of resistance by certain strains of Botrytis, Penicillium and Monilinia, and because control of Rhizopus, Alternaria or Mucor is not claimed by other pesticides labeled for this site. Some packing houses in the Northwest treat harvested cherries with a chlorine bath before the fungicide drench. This treatment is only registered to reduce fungus spores and is not as effective as captan against post-harvest diseases. In addition, because the fruit must be dried between the two processes, it is a more expensive and time-consuming process.

Conclusion: EPA believes that about 85 percent of cherries receive either pre- or post-harvest treatments with captan. EPA agrees with the comments received that resistance to some captan alternatives on cherries has been demonstrated, and that with some alternatives there are both limitations on the time of application and lessened efficacy. EPA also agrees that the benefits of pre-harvest and post-harvest uses of captan are larger than were initially estimated and now estimates the benefits of captan's pre- and post-harvest uses on this crop to be at least $4.6 million annually.

8. *Cranberries.* The PD 2/3 did not address the benefits resulting from the use of captan on cranberries specifically, but rather as part of the small berries. Since then, EPA has received information that there is very little use of captan on this crop: about 1 percent nationwide and up to 5 percent in the western areas of the United States.

Conclusion: EPA believes that while captan can be beneficial to some cranberry growers, it is not widely used and is not regarded as important for disease control on this crop.

9. *Cucumbers.* Prior to issuing the captan PD 2/3, EPA had no information available on the percent of cucumber acreage treated with captan. This crop was grouped in EPA's estimate of the benefits of captan's use on vegetables, and EPA considered it unlikely that there would be any negative impact on producers or consumers if captan were not available on this site.

Information received from the Captan Task Force on cucumbers indicates that there is very little post-plant use of captan on this crop. The Task Force reported that the alternatives to captan: chlorothalonil, maneb and metalaxyl are more efficacious.

Conclusion: EPA maintains its position in the PD 2/3 that there is little use of captan on cucumbers and estimates that less than 1 percent of this crop is treated with captan nationwide. EPA agrees that adequate alternatives to captan are available for both commercial and home use.

10. *Eggplant.* The PD 2/3 did not address the use of captan specifically on eggplant.

Conclusion: EPA has since evaluated the use of captan on eggplant and has concluded that captan is used for disease control as a plant-bed or flat treatment and for this use there are no alternatives. Alabama, New Jersey, New York and Georgia recommend this use and they (together) account for a substantial portion of the total U.S. eggplant acreage. Thus, the loss of captan would be a major loss to the eggplant growers of these states. There is little use of captan as a foliar treatment for which there are several alternatives including maneb, zineb, fixed coppers and ziram.

11. *Grapes.* In the PD 2/3, EPA had limited data available to estimate the impact of the cancellation of captan on grapes although it was believed unlikely that the loss of captan would have a major impact. The Captan Task Force claims that the chemical costs to growers would increase significantly if captan were not available for use on grapes.

The Task Force estimates that about 20 percent of California grapes are treated with captan. Their research shows that the efficacy and comparative performance of some of the alterpative chemicals generally would be about the same as captan. However, without captan, more than one chemical would be needed to control the five major diseases on muscadine grapes. The Captan Task Force estimates that between 50 and 80 percent of all muscadine grape acreage is treated with captan and approximately 10 percent of that acreage is treated eight times each season. There are no alternatives to control either ripe rot or bitter rot on these grapes, and the only alternative for Macrophoma rot is benomyl which is only used in combination with captan because of the resistance problem. For Botrytis, iprodione and vinclozolin are potential chemical alternatives to captan and Botrytis may also be controlled by removing the leaves from around clusters. This latter measure is very labor intensive (approximately $200 per acre) and the Task Force believes that it would only be economically viable in premium wine growing areas.

Conclusion: Since the voluntary cancellation of folpet on food crops and the emergency suspension of dinoseb, only captan and mancozeb have full Federal registration for control of Phomopsis cane and leaf spot. Mancozeb is in Special Review with the other EBDC fungicides. Sodium arsenite is registered for use in California but some wineries will not accept grapes treated with this chemical. Sodium arsenite is currently in Special Review and the State of California is also reviewing the use of this chemical under its Birth Defects Prevention Act.

EPA agrees that there are major benefits from using captan on grapes since its broad spectrum activity prevents resistance to other fungicides and it protects against diseases for which good alternatives are not available. EPA estimates the benefit of having captan available for use on grapes at $1.2 million per year.

12. *Lettuce.* In the PD 2/3, EPA addressed the likely benefit of having captan available for use on lettuce as part of its assessment of a number of vegetable and fruit crops. No data were available to make a specific estimate of the importance of captan on lettuce although EPA believed that the cancellation of captan on this crop would not have a major economic impact.

The Cooperative Extension Service, University of California commented that there are significant benefits to the use of captan on lettuce and has recently indicated its willingness to generate residue data to support continued registration of the use.

Conclusion: EPA now estimates that up to 5 percent of lettuce produced in the United States is treated with captan. Although captan gives only fair control on downy mildew, a broad spectrum fungicide is necessary to use with metalaxyl or benzimidazole fungicides because of the resistance problem. The current alternatives to captan include maneb, maneb and metalaxyl, maneb and zinc, zineb, and for seed beds only: coppers and lime. Maneb and zineb are in Special Review. The economic impact of the loss of captan is estimated to be $2.2 million.

13. *Mangoes.* The PD 2/3 did not address the use of Captan on mangoes. However, after investigating the benefits of this use, EPA now believes that captan is of major importance to this minor crop as a broad spectrum fungicide to be mixed or alternated with triadimefon and benomyl. Without captan there would be a build-up of resistance to these alternatives. Captan effectively controls Cercospora leaf blotch or spot, post-harvest molds, and storage rots including Botrytis, Glecosporium and Rhizopus.

14. *Onions.* The PD 2/3 addressed vegetable uses as a group, including the use of captan on onions. The available data indicated that captan is not used extensively on onions. Comments received since the PD 2/3 from the Cooperative Extension Service at the University of California indicate that there are significant benefits from the use of captan on green onions. Captan is effective for Botrytis control on green onions and the only alternative is chlorothalonil.

EPA has not received any comments regarding the benefits of captan for disease control on dry bulb onions. EPA estimates that less than 1 percent of onions (dry bulb and green) produced in the United States are treated with captan. Alternatives to captan for disease control on dry bulb onions include a combination of metalaxyl and chlorothalonil, mancozeb, and combinations of zineb, iprodione and chlorothalonil.

Conclusion: EPA agrees that there are viable alternatives to captan for disease control for dry bulb onions but that captan is important for the production of green onions as chlorothalonil is the only available alternative.

15. *Peaches and Nectarines.* In 1985, EPA's assessment was that the loss of captan on peaches would result in annual losses to growers ranging from $2.3 million to $5 million due to increased disease control costs and lost peach production. The loss of captan on nectarines was estimated to result in losses of up to $650,000 per year. It was thought likely that these costs would be passed on to the consumer.

Industry's Captan Task Force expressed concern about the potential loss of captan on peaches. They estimated that between 90 and 100 percent of peach acreage is treated at least once with captan and that it is important to growers because of its low price and because it is not subject to

resistance build-up. Captan can be used in combination with many products including benomyl, dodine and thiophanate-methyl. In California, labelling requirements prohibit the use of benomyl alone on peaches and nectarines. They believe that cancellation of captan would leave them without an affordable, effective brown rot control agent. The only non-chemical control mentioned by the Captan Task Force was for anthracnose, on both peaches and nectarines. They suggest that nurseries should be cleaned before trees are sold in order to reduce inoculum, and suggest increased mowing and herbicide use to control vegetation.

The South Carolina Peach Council and Promotion Board commented that captan is invaluable in the control of bacterial spot, brown rot, blossom blight and scab which all occur frequently in the state's damp and humid climate. EPA also received comments from the North Carolina Peach Grower's Society, Inc. expressing its members' concern over the proposed cancellation of captan. In their view, captan has been more effective than sulfur which they regard as the only available alternative.

The Louisiana Cooperative Extension Service expressed their concern about the proposed cancellation of captan on peaches. Its alternatives were described as including chlorothalonil, benomyl and triforina. Captan has been used for 20 to 25 years on this crop at an estimated rate of 5,000 pounds of active ingredient per year.

Conclusion: EPA estimates that about 60 percent of peaches and 60 percent of nectarines are treated with captan. EPA's current estimate of the impact of cancelling the registered use of captan on peaches is that it would result in a $30.00 per acre increase in treatment costs annually of up to $5 million per year overall. There were no benefits data submitted on nectarines to suggest that EPA should change its earlier benefit assessment of this captan use. EPA maintains its position that the loss of captan on nectarines would result in increased disease control costs of up to $650,000 annually. As stated in the PD 2/3, while the consumer would probably not experience price increases initially if the use of captan is not available on peaches and nectarines, the costs resulting from the unavailability of captan may be passed on if fungicidal resistance continues to develop.

16. *Pears.* EPA's PD 2/3 assessment of the benefits of captan on pears was that its use on this crop was not significant.

Currently available data indicate that most pears produced in the United States are grown on the West Coast. California and Washington each account for about 36 percent, and Oregon produces about 24 percent of this crop. Industry's Captan Task Force reports that there is little pre-harvest use of captan on pears. The major disease that is controlled by pre-harvest treatment with captan: pear scab, is rare and geographically concentrated and that there are viable alternatives to captan.

The Task Force also reports that captan is not used as a post-harvest treatment in California which has a dry growing season. However, industry data indicate there are significant benefits associated with the post-harvest use of captan on pears in Washington and Oregon. Approximately 60 percent of the packing houses in Washington and about one-third of those in Oregon, where there are cool, wet periods, use a combination of captan and benomyl as a post-harvest treatment. The Task Force estimates that half of the 166,000 tons of pears currently treated with captan would be lost if captan were not available because the benzimidazoles are not registered, or not effective for controlling Mucor molds or shot-hole in pears. The economic impact of this loss has been estimated by the Washington Tree Fruit Research and Extension Center to be approximately $18 million in Washington and by the Hood River Experiment Station, Oregon State University to be $7 million in Oregon (References 10 and 19 in the Task Force submission).

Conclusion: EPA concludes that captan is not important as a pre-harvest treatment on pears but estimates that about 35 percent of pears are treated post-harvest with captan. While EPA may not agree with the comments received as to the exact magnitude of the estimated benefits, it agrees that there are significant benefits of at least $16.3 million annually from the post-harvest use of captan on pears.

17. *Peppers and pimentos.* The PD 2/3 did not address the use of captan on peppers and pimentos specifically but considered this use with other vegetable uses of captan as a group. EPA had no information to suggest that captan is important for disease control on this crop.

Information received since the PD 2/3 indicates that captan is important as a plant-bed treatment for peppers and pimentos. Captan is important in slowing the build-up of resistance to metalaxyl which is the only alternative for plant-bed treatments for these crops. EPA believes that there is little use of captan as a foliar treatment for which the alternatives are a combination of fixed copper and maneb, zineb, ziram and metalaxyl.

Conclusion: In its current assessment, EPA believes that captan is important for disease control as a plant bed or flat treatment but not as a foliar treatment for peppers and pimentos.

18. *Plums/Prunes.* In EPA's PD 2/3 on captan in 1985, only limited data were available on the use of captan on plums/prunes and no economic assessment was provided. Comments received from the Captan Task Force indicate that plums are rarely infested with disease and that very little plum acreage is treated with captan. Their data show that the alternatives to captan including triforine and iprodione provide equal or better control for brown rot.

However, information provided by the Captan Task Force indicates that captan is used on most prune acreage. It is the only chemical available for the control of russet scab and is highly effective in controlling brown rot. The Task Force predict substantial increases in disease control costs if captan were not available for this use.

California Prune, Raisin and Walnut Research of Prunes, California commented that one advantage of captan for prune and raisin growers is that it protects the crops from a fairly broad spectrum of organisms at a reasonable cost. Another perceived advantage of captan is that it fits better than its alternatives into an Integrated Pest Management program because it does not evoke resistance and does not affect beneficial non-target organisms such as mites.

Conclusion: EPA now estimates that about 85 percent of prunes are treated with captan by foliar application and believes there are significant benefits from this use of captan. EPA agrees with the Task Force that there is probably minimal use of captan on plums other than prunes.

19. *Spinach.* In the PD 2/3 EPA had no information available on the benefit of having captan available for use on spinach. Current information shows that captan is recommended for damping-off control as a pre-plant soil treatment in New York. The alternative to captan for plant-bed treatment is metalaxyl. Captan is not registered for foliar use on spinach.

Conclusion: EPA estimates that less than 5 percent of U.S. spinach acreage is treated with captan; however the only alternative to captan for plant-bed treatment is metalaxyl and captan is beneficial in slowing the build-up of resistance to this alternative. EPA now believes that in some areas the use of

captan as a plant-bed treatment for spinach has substantial benefits.

20. *Strawberries.* In 1986 EPA expected major losses to occur for producers if captan were not available for use on strawberries. It was estimated that without captan, growers would use some combination of thiram and vinclozolin which would increase annual treatment costs by about $5.9 million. EPA anticipated that producers would pass on these increased costs of about $200 per acre to the consumer which would result in only a small change in typical fresh fruit expenditures.

Comments received from a registrant disagreed with EPA's assessment that there would be only a small consumer impact if captan were cancelled. They expressed their concern about the problem of resistance to captan's alternatives and their position that the build-up of resistance was being delayed by an alternating treatment schedule using vinclozolin and a combination of captan and benomyl.

The Captan Task Force's recent assessment of the resistance problem is that without captan, chemical costs to growers would increase significantly if they attempted other methods of disease control and that it is likely that many growers would stop producing this crop. The Task Force estimates that 12 to 20 alternating applications of vinclozolin and benomyl would be necessary without captan which has a broader spectrum of control and has not shown resistance problems.

Comments received from the Florida Strawberry Growers Association in support of the continued availability of captan noted that Florida's temperature and humidity make the systematic application of captan essential for disease control. They asked that any data being considered in the decision to cancel captan should include data specific to Florida where all of the 4,900 acres producing strawberries are treated with captan.

A plant pathologist from the Louisiana Cooperative Extension Service, Louisiana State University Agricultural Center also supported the continued availability of captan, particularly on strawberries, noting that there are very few alternatives to captan on this crop.

Information received from USDA indicates that captan is widely used on strawberries with 60 to almost 100 percent of the crop treated depending on the state.

Conclusion: EPA agrees that a high percentage of the U.S. strawberry crop is treated with captan: approximately 85 percent nationwide, and continues to believe that without the use of captan, producers of strawberries would have significant cost increases estimated at about $5.9 million per year. In addition, EPA agrees that captan may provide a deterrent to the development of fungal resistance.

21. *Taro.* In the PD 2/3, taro was grouped with other vegetables for which EPA had no information indicating that there were significant benefits from the use of captan. Current information indicates that captan is the only remaining fungicide for use on taro. It is used as a pre-plant soil treatment to prevent Pythium soft rot of corms.

Conclusion: EPA's assessment is that this use of captan has significant benefits even though less than 10 percent of this crop is treated with captan.

22. *Tomatoes.* There was no information available to EPA on captan's use on tomatoes and the PD 2/3 did not address this use specifically; however, EPA did not believe that there were major benefits from the use of captan on vegetable crops.

Industry's Captan Task Force submitted information showing that there is little use of captan on tomatoes and, in their assessment, little if any benefit is derived from this use.

EPA estimates that less than 1 percent of tomatoes are treated with captan nationwide. However, information has been submitted by the USDA claiming that captan is used on 100 percent of the Tennessee tomato crop as a plant-bed drench. In addition, information received from a University of Tennessee plant pathologist, indicates that there are no effective alternatives to captan for this use. EPA has not received any information showing benefits from foliar uses of captan on tomatoes.

Conclusion: EPA agrees that captan can be important for use on tomatoes as a plant-bed treatment in certain areas but not as a foliar treatment.

23. *Other fruits and vegetables.* In the PD 2/3, EPA assessed the impact of the cancellation of captan for a group of fruit and vegetable crops (including cherries, citrus, grapes, papaya, pears, plums, prunes and taro) as between $1.2 and $3 million. At that time, data were not available to make more specific estimates although EPA believed that it was unlikely that individual producers would be faced with major losses.

24. *Seed Treatments.* In the PD 2/3, EPA assessed the impacts of cancelling the use of captan as a seed treatment. The use of captan on the following seed was discussed: corn, cotton, sorghum, soybeans, peanuts, rice, small grains, potatoes, and vegetables. EPA estimated that approximately $9 million in benefits may be realized from the availability of captan as a seed treatment. No additional information was submitted to EPA which would require this estimate to be revised.

Some of the sites for which EPA did not have data previously have already been described in Unit IV.A 1 through 24 of this Notice. Based on information received since the PD 2/3, EPA maintains its position that there are benefits in having captan available for some of these crops (e.g., cherries, grapes, plums/prunes and taro). After evaluating the data and comments received on other fruit and vegetable crops (e.g., citrus and many vegetable crops), EPA believes that there are minimal, if any, benefits in having captan available for use on these sites.

Listed in the following Table 4 are the registered food uses of captan that are not discussed in Unit IV.A 1 through 24. For most of the sites listed, captan is used on less than one percent of the crop nationwide and viable economic alternatives to captan are available. Also listed are a few of the registered uses of captan for which EPA has no indication of use.

TABLE 4—SUMMARY OF OTHER CROPS WITH MINIMAL USE AND ADEQUATE VIABLE ALTERNATIVES OR WITH NO INDICATION OF USE

Use	Percent of site treated	Economic alternatives
Avocado	<1	benomyl, fixed coppers.
Beans [1]	<1	metalaxyl, sulfur, zineb.
Beets	<10	fixed coppers, zineb.
Broccoli	<1	thiram, benomyl, hot water treatment.
Brussels sprouts.	<1	thiram, benomyl, hot water treatment.
Cabbage	<1	thiram, benomyl, hot water treatment.
Carrots	<5	chlorothalonil, mancozeb, maneb, zineb, triphenyltin hydroxide.
Cauliflower	<1	thiram, benomyl, hot water treatment.
Citrus	<1	coppers, benomyl, imazalil, Biphenyl, sodium orthophenylphate, thiabendazole.
Collards	<1	thiram, benomyl, hot water treatment.
Cotton		etridiazole (Terrazole®), PCNB, 2-(thiocyanomethylthio), benzothiazole (TCMTB), thiram + carbaryl + chloranil + formaldehyde.
Crabapple [2]		
Kale	<1	thiram, benomyl, hot water treatment.

TABLE 4—SUMMARY OF OTHER CROPS WITH MINIMAL USE AND ADEQUATE VIABLE ALTERNATIVES OR WITH NO INDICATION OF USE—Continued

Use	Percent of site treated	Economic alternatives
Leeks [2]		
Mustard greens	<1	thiram, benomyl, hot water treatment.
Peas	<1	metalaxyl, zineb, fixed coppers.
Pineapple	<1	benomyl, fosetyl-Al (Aliette®).
Potatoes	<1	metalaxyl, maneb, mancozeb metiram, chlorothalonil, TPTH + mancozeb.
Pumpkin/ Squash	<5	chlorothalonil, mancozeb, maneb + zinc, anilazine, ziram, metiram.
Quince [2]		lime sulfur, chlorothalonil, mancozeb, ziram.
Rhubarb [1]		dichlone (Delsene®), maneb.
Rutabaga	<1	thiram, benomyl, hot water treatment.
Shallots [2]		
Soybeans	<1	maneb + zinc, chloroneb, carbasin + thiram, PCNB + Terrazole®, metalaxyl.
Sweet corn	<1	mancozeb, chlorothalonil.
Turnips [2]		thiram, benomyl, hot water treatment.
Watermelon	<10	chlorothalonil, mancozeb, maneb + zinc, anilazine, ziram, metiram.

[1] Beans: VA: 75% (6,200 acres); Broccoli: TN: 100 (100 acres); Rhubarb: MI: greenhouses.
[2] No indication of use.

B. Non-Food Uses of Captan

1. *Agricultural non-food uses—a. Home gardens.* In the PD 2/3 it was estimated that about 100,000 pounds of captan active ingredient is used in products marketed for use by home gardeners. Captan is used on a variety of sites including house plants, ornamentals, fruits and vegetables. There were no data available to estimate the specific benefits of captan to the home user but it was considered likely that the same alternatives could be employed as for commercial sites.

EPA has no data to indicate the economic impact to the home user if captan is not available. However, for those sites for which there are established markets, use is occurring and few alternatives are available. It is EPA's position that the marketability of this broadspectrum fungicide in the home user market is testimony to its perceived benefits.

b. *Forest nurseries.* EPA previously believed that there were adequate alternatives to captan to control damping-off in forest nurseries. In the PD 2/3 it was estimated that captan is used to treat about 8 percent of the U.S. forest nursery acreage. No comments or additional information on this use were submitted in response to the captan PD 2/3 and EPA has not revised its estimate of usage. However, the additional information received about the benefit of having captan available for plant-bed treatments of captan food uses has led EPA to revise its position that the alternatives (thiram, dazomet, TCMTB and ETCMTD plus thiophanate-methyl) are not always equivalent to captan in controlling damping-off. EPA now believes that there is some benefit to having this use of captan available.

c. *Turf.* In the PD 2/3 it was estimated that less than 1 percent of turf in the United States is treated with captan. Thiram was believed to be the only alternative which provides protection against a comparable range of diseases. EPA has received no additional information on this captan use and supports its previous finding that the use of thiram in place of captan would result in an annual increase in disease control costs of about $28,000.

d. *Ornamentals.* EPA concluded in the PD 2/3 that the principal uses of captan on ornamentals are for the control of certain disease on carnations, corm rot on gladiolus, and selected diseases on field grown roses. It was estimated that there would be cost increases for each of these sites if captan were not available. The costs of alternatives were expected to range from $40,000 on gladiolus to about $96,000 on roses.

In contrast to the relatively minor additional production costs for corms and roses, it was estimated that the loss of captan would have a major impact on the carnation cut flower industry. Losses were estimated at $6 million per year for the domestic carnation cutting producers (producing plants for flower growers) and up to $12 million in losses from loss of plantings due to increased disease pressure.

EPA has received no additional data on the uses of captan on ornamentals and supports its earlier assessment of the benefits of captan for these uses.

2. *Non-agricultural uses—a. Soaps/pet shampoos/pet powders.* EPA has no new information on the use of captan in sanitizing deodorant-powdered hand soap and supports its position in the PD 2/3 that there is some benefit in having captan available as an antimicrobial agent in powdered soap.

EPA's position on pet shampoos and pet powders was that there were no registered alternatives to captan for these uses and that having captan available therefore provided some benefits.

EPA supports its position in the PD 2/3 that there are some benefits to having captan registered for use in pet powders and pet shampoos.

The registrant of the only remaining registration of a pet shampoo/dip containing captan requested that it be voluntarily cancelled (January, 1989).

b. *Plastics/paints/adhesives/aerosol sprays/packing boxes.* In the PD 2/3 EPA estimated that there were some benefits to the uses of captan as a biocide incorporated in plastics, adhesives (including wallpaper pastes), oil and water based paints, fabric for mattresses and pillows, aerosol sprays and packing boxes used in transporting fruits and vegetables. EPA did not calculate the economic benefits of having captan available for each of these products but estimated that there were at least minimal benefits to these minor uses of captan.

EPA has not received any additional information regarding these products and therefore supports its previous position that these are minimal benefits from these uses.

C. Conclusions

EPA underestimated the benefits associated with the use of captan on food (excluding seed treatments) in the PD 2/3. It was estimated that these uses resulted in benefits ranging from $11.3 to $23.7 million. Based on information received subsequent to the issuance of the PD 2/3, EPA now believes these uses account for between $67.8 to $75.1 million in benefits.

No information was submitted regarding the non-food uses that would require EPA to revise its earlier assessment of benefits. EPA's revised estimate of benefits resulting from all uses of captan is now estimated to be $76.8 to $86.1 million.

V. Comments of the Scientific Advisory Panel Secretary of Agriculture

A. Comments of the Scientific Advisory Panel

EPA presented its proposed decision on captan at a public meeting of the Scientific Advisory Panel held in Arlington, Virginia, on September 26, 1985. The Panel issued its response in a written report of October 4, 1985. The Panel's report is reproduced below in its entirety.

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) Scientific Advisory Panel (SAP) has completed review of a set of scientific issues

associated with captan. The review was conducted in an open meeting held in Arlington, Virginia, on September 28, 1988. All Panel members were present. In addition, two new designees to the SAP, Dr. Thomas Clarkson and Dr. James Swenberg, participated in the review.

Public notice of the meeting was published in the Federal Register on Friday, August 30, 1988.

Oral and written statements were received from Stauffer Chemical Company and Chevron Chemical Company.

In consideration of all matters brought out during the meeting and careful review of all documents presented, the Panel unanimously submits the following report:

Report of SAP Recommendations

The Scientific Advisory Panel has reviewed the materials prepared for it on captan, and responds as follows to the issues presented to it by EPA. The four scientific questions posed to the SAP by EPA, are listed below, together with the Panel's response:

Issue: 1. Several studies have shown that captan is oncogenic in a number of species of test animals: Innes et al., 1969 (mice); National Cancer Institute, 1977 (mice and rats); Chevron, 1983 (mice); BioDynamics, 1988 (mice); Stauffer/Chevron, 1988 (rats). Does the Panel agree with EPA's qualitative assessment (i.e., weight of the evidence conclusions) of the oncogenic potential of captan.

Response: One mouse study demonstrates oncogenic effects in the duodenum of mice exposed to high doses. Two other studies are less convincing, but are suggestive because they indicate tumors at the same site. The rat studies are equivocal at best in indicating oncogenicity.

Issue: 2. EPA calculated the geometric mean of five oncogenicity studies to determine the potency value (Q_1^*) of captan. Does the Panel agree with EPA that this approach is appropriate for estimating dietary and applicator risk.

Response: Absolutely not. The Panel does not believe this approach is useful because the five studies are not of equal value. Furthermore, the Panel has grave reservations over the procedures and assumptions that go into dose quantification and use of Q star values. The Panel feels that Agency position documents must stress upper and lower bounds, and provide the best estimate.

Issue: 3. In the absence of acceptable field data on residues of captan in or on food crops, EPA conducted a "worst-case" calculation of dietary risk. Are the methods used for estimating human dietary exposure to captan appropriate? To what degree should EPA use FDA's Market Basket survey data?

Response: The Panel does not believe the methods used for estimating human dietary exposure to captan are appropriate. First of all, the Panel disagrees with EPA's practice of estimating human dietary exposures based on tolerances. EPA should use the best available residue data. In this case, the FDA's Market Basket Survey data should have been used to the maximum extent possible. If EPA does not wish to use Market Basket Survey data, there are alternative methods available for making estimates more realistic.

Issue: 4. Available data (Roberts, 1970) suggested possible teratogenic effects in hamsters. These effects were encephaly and fused ribs and occurred only at maternally toxic levels. Additional information from a second study (Goldenthal, 1978) on the hamster demonstrated only fetotoxic effects. These effects were reduction in fetal weight at maternally toxic levels. Does the Panel concur with EPA's judgment that captan is not teratogenic in the hamster? The Panel should note that the PD 2/3 indicates current studies were inadequate and that an additional study on hamsters would be required. However, subsequently EPA has conducted a reregistration review and determined that an additional hamster study is not needed. That review is enclosed for the Panel's consideration.

Response: The Panel concurs with EPA's judgment.

For the Chairman.

Certified as an accurate report of findings:

Philip M. Gray, Jr., Executive Secretary,

FIFRA Scientific Advisory Panel.

Date: October 4, 1988.

EPA response: The SAP's evaluation of EPA's qualitative assessment of the oncogenic potential of captan (issue 1) and the Panel's finding that EPA's initial method of determining the potency or Q_1^* of this fungicide was inappropriate (issue 2) were taken into consideration in EPA's Second Peer Review of captan. The Second Peer Review and determination of a new Q_1^* for captan are discussed in Unit II.A.6. of this Notice.

The Panel disagreed with EPA's use of tolerances in estimating dietary exposure to captan (issue 3). In this final determination on captan, EPA has used the best available residue data which includes field monitoring data received since the PD 2/3 was issued; tolerances were only used in calculating exposure to crops for which no better data are available. Dietary exposure to captan is discussed in Unit III.A. of this Notice.

In concluding this Special Review of captan, EPA notes the SAP's concurrence with EPA's finding that captan does not cause teratogenic effects (issue 4). Teratogenicity is discussed in Unit II.C. of this Notice.

B. Comments of the Secretary of Agriculture

EPA received a preliminary response dated September 23, 1988, from the U.S. Department of Agriculture (USDA) regarding the proposed decision and Notice of Intent to Cancel and the Technical Support Document on captan issued in June, 1988. In September 1988, the Office of the Secretary was asked to submit USDA's final comments to be addressed in EPA's final decision and completion of this Special Review. USDA's, final comments appear below in their entirety.

September 15, 1988

Mr. Charles L. Smith, Coordinator, Pesticides & Pesticide Assessment, Office of the Secretary, Department of Agriculture, Washington, DC 20250

Dear Mr. Smith: EPA announced its proposed Preliminary Determination regarding captan uses on June 21, 1988 (50 FR 25884). The Federal Register Notice requested public comments regarding the benefits provided from captan and allowed a 45-day comment period. In your preliminary response of September 23, 1988, you deferred comment until it became clearer which uses were in jeopardy, which uses the chemical industry intended to defend, and consequently, what data needed to be generated.

The Captan Registration Standard, issued in June 1988, imposed a number of data requirements on captan registrants. Failure to commit to supply some of these data has resulted in the suspension of some of the uses of captan. Additionally, EPA has recently received written confirmation of the uses of captan which are being supported by the Captan Industry Task Force. A copy of this letter is enclosed for your information.

In light of this information, EPA again invites comments regarding its proposed preliminary determination for captan, in particular the benefits associated with its use. In order that your comments can be considered in its final determination, EPA requests that they be submitted within 60 days.

Sincerely,

Douglas D. Campt,

Director, Office of Pesticide Programs.

December 22, 1988

Mr. Douglas D. Campt,

Director, Office of Pesticide Programs, U.S. Environmental Protection Agency, 401 M Street SW., Washington, DC 20460.

Dear Mr. Campt: This is in further response to your letter of September 15 regarding the fungicide captan. In our initial response of October 12, we indicated we were pursuing an in-depth assessment of basically all chemical fungicides including captan. We are cooperating with the Biological and Economic Analysis Division in our efforts.

We would like to call your attention to the fact that we previously generated assessment reports on the ethylenebisdithiocarbamate (EBDC) fungicides (1979) and captan (1982). EPA has both of these reports on file. The preliminary data we are currently receiving from the states indicate that the uses of these fungicides are essentially the same as discussed in these earlier reports. The major difference lies in the fact that pest resistance to pesticides has become an important factor in the use of the more recently developed systemic fungicides. Because these newer fungicides are highly specific in their modes

of action, pest resistance is likely to occur relatively soon if these chemicals are used exclusively. States have developed resistance management programs that rely heavily upon the inclusion of captan and/or EBDC fungicides in concert with the highly specific newer chemicals.

If you find it imperative to make a decision before the completion of our new study on chemical disease control, we urge you to take advantage of the material already submitted.

Sincerely,

Charles L. Smith,

Coordinator, Pesticides and Pesticide Assessment.

EPA response: EPA has considered the benefits information provided by the USDA including the draft report (December 6, 1988) giving recent state estimates of captan usage. This information is referred to throughout Unit IV. of this Notice which summarizes EPA's benefits assessment and evaluation of comments and additional data received in response to the PD 2/3. EPA has also considered the problem of resistance, particularly resistance to the newer site-specific fungicides and has addressed the availability of viable alternatives to captan, including the EBDCs as part of its fungicide strategy. Both resistance problems and alternative fungicides are discussed in Units IV. and VI. of this document.

VI. Risk/Benefit Assessment and Initiation of Regulatory Actions

A. Introduction

In its PD 2/3, EPA estimated the total dietary risk from captan food uses as 10^{-4} to 10^{-3}. EPA proposed to cancel the use of captan products for all food crops but to require additional residue data to determine actual food residue levels before making a final determination. The decision to cancel all food uses of captan was based on the conclusion that the cancer risks outweighed the moderate benefits.

In the absence of more accurate data on likely residues EPA based the calculations of dietary risk on established tolerances which represent the highest residue levels which may legally be present on food crops treated with captan. EPA proposed to retain any use for which there were data showing that anticipated residues are sufficiently lower than the tolerances.

EPA further proposed to permit the use of captan as a seed or seed piece treatment but to require submission of residue data to establish tolerances for treated seed and to determine whether the residues, if detectable, are of concern. The data are to be submitted in July, 1989.

EPA also proposed to allow the continued use of captan detreated corn seed as feed for cattle and hogs. A tolerance of 100 ppm on detreated corn seed was established in November, 1981 in connection with 40 CFR 186.500 (formerly codified as 21 FR 561.65). Additional residue data necessary to support this tolerance have not been submitted and consequently EPA will be proposing to revoke this tolerance through a notice in the **Federal Register.**

The risks from non-dietary exposure to captan ranged from 10^{-5} to 10^{-4} for animal shampoos to "negligible" for uses including industrial incorporation of captan in plastics and paints. The highest and most typical risks for mixer/loaders and applicators were 10^{-6} to 10^{-5}. The risk from exposure to home garden uses of captan was calculated as 10^{-7}.

EPA proposed measures that would reduce these non-dietary exposure levels. For persons mixing or loading formulations, applying captan, harvesting or weeding in captan treated areas, incorporating captan in adhesives, paints and plastics or using products containing captan, EPA proposed to require the use of protective clothing and other safety measures. These measures included the use of dust masks and protective suits for mixer/loaders and the use of chemical resistant gloves for all uses of captan. Label changes resulting from these proposals were specified in the Registration Standard issued in March, 1986 and amendments issued in April 1986 and 1987.

B. Risk/Benefit Assessment: General

1. *Risks.* Additional data and comments were received in response to the PD 2/3 and in response to Data Call-In Notices issued under FIFRA section 3(c)(2)(B). EPA has reviewed these submissions and they are presented and discussed in the appropriate units of this Notice.

Based on all the available evidence, EPA supports its earlier classification of captan as a Group B_2 (probable human) carcinogen. The new overall Q_1^* for captan, based on the Chevron high-dose study (Ref. 7) showing tumors of the gastrointestinal tract in both male and female mice, is 3.6×10^{-3} (mg/kg/day)$^{-1}$ (geometric mean). The data do not, however, show that captan causes teratogenic, reproductive or mutagenic effects that warrant EPA concern.

The upper-bound lifetime oncogenic risk from dietary exposure to captan from all registered food uses is now estimated to be 10^{-6} to 10^{-5}. This is the sum of the risks from the more than 60 food uses of captan. There is no individual crop for which the risk is higher than 10^{-6}. As discussed in Unit III of this Notice, the dietary exposure estimates were based on the best data available to EPA. Although most of these data more accurately reflect levels likely to be consumed in the diet than those in the PD 2/3, EPA still believes that actual dietary exposure, and thus risk, is overestimated.

The risks from non-dietary exposure to captan range from 10^{-7} to 10^{-5} for mixer/loaders and applicators for agricultural uses of captan. In the PD 2/3 risks for fieldworkers/harvesters were estimated at 10^{-6} to 10^{-4} based on studies on exposure to captan on strawberries. EPA will reevaluate these risks when additional data, recently received by EPA, have been reviewed.

The risks from home uses of products containing captan include estimates of 10^{-6} for oil-based paints and 10^{-7} for home garden products. The calculations of risks for home uses of captan do not assume that the user is wearing protective clothing and gloves. They therefore represent a conservative estimate of risk to the home user.

Protective clothing and other safety measures, some of which were proposed in the PD 2/3, have been specified through the captan Registration Standard and amendments. In general, it is anticipated that compliance with these measures will reduce the risks from non-dietary exposure to captan by one order of magnitude.

2. *Alternatives.* The PD 2/3 contained a table of the major alternatives to captan and a summary of their toxicological effects. Table 5 is an updated version of this table.

TABLE 5.—SUMMARY OF TOXIC EFFECT OF MAJOR CAPTAN ALTERNATIVES

Fungicide	ONCO	MUTA	REPRO	TERAT	Status
Anilazine (Dyrene®)	?	?	?	?	RS 12/83.
Benomyl (Benlate®) [1]	C	+	+	+	SR 82; SRR 87.
Carboxin	?	+/−	−	−	RS 8/87.

TABLE 5.—SUMMARY OF TOXIC EFFECT OF MAJOR CAPTAN ALTERNATIVES—Continued

Fungicide	ONCO	MUTA	REPRO	TERA?	Status
Chlorothalonil	B_2	–	–	–	SRR 9/89*.
Dodine	?	?	?	?	RS 2/87.
EBDCs (maneb, mancozeb, metiram, zineb)	B_2/?	+/–	–/?	–/+	SR 88.
Fosetyl-Al (Aliette®)	C	–	–	–	RS 83; SRR12/88.
Imazalil	–	–	–	–/?	
Iprodione	–	–	–	–	
Metalaxyl (Ridomil®)	E	–	–	–	SRR 3/88*
PCNB	?	–	?	?	RS 1/82.
Sodium orthophenylphate (SOPP)	+	+/–	?	?	
Sulfur	*	*	*	*	RS 1/83.
Thiabendazole	?	?	?	?	
Thiophanate-methyl [1]	?	–	–	?	SR 88; RS 88*.
Thiram	?	–/+	–	–	RS 7/84.
Triadimefon	+	–	–	–/+	
Triforine	?	–	?	–	
Vinclozolin	–	–	?	–	
Ziram	?	?	?	?	

Key to symbols and abbreviations: (+): positive finding; (–): negative finding; (*): no additional data required; (?): data gap; ONCO: oncogenic classification (A,B,C,D,E): based on Guidelines for Carcinogen Risk Assessment (51 FR 33992); MUTA: Mutagenic; REPRO: reproductive effects; TERA?: teratogenic; RS: Registration Standard (*:Draft); SR: Special Review; SRR: Second Round Review (formerly FRSTR).

[1] Benomyl and thiophanate-methyl convert to MBC, a common metabolite, which is a classified C oncogen.

Two of the major alternatives originally appearing in the table are no longer available. All captafol registrations and all folpet food use registrations were voluntarily cancelled in 1987. Of the alternatives to captan, only chlorothalonil and the EBDCs (mancozeb, maneb, metiram and zineb) are B_2 carcinogens. Available data indicate the remaining alternatives are either not oncogenic, have only limited evidence regarding carcinogenicity, or do not have adequate oncogenicity testing. While benomyl is a positive carcinogen, teratogen, and reproductive toxicant, EPA has recently evaluated the risks to benomyl (Registration Standard issued July, 1987), and has determined those risks to be acceptable. Also, due to resistance problems, benomyl would not likely increase much in market share if captan were cancelled.

Since captan is a broad spectrum fungicide, cancellation of its use on a particular site would likely result in the use of two or more of its alternatives. Only the EBDCs and chlorothalonil offer the breadth of control that captan does; consequently, although cancellation of the use of captan could result in the use of a pesticide that is a less potent carcinogen or not carcinogenic, more pesticide applications would likely be required to achieve an equivalent level of control. Additionally, captan has been found not to be teratogenic or mutagenic and there are no concerns regarding reproductive effects, whereas there are concerns for some of these effects for a number of captan's alternatives.

As part of EPA's comparative risk/benefit assessment of major fungicides, the dietary risks for various possible cancellation scenarios for the B_2 fungicides, captan, chlorothalonil and the EBDCs, were evaluated. The EBDCs are currently in Special Review and EPA's Preliminary Notice of Determination (PD2/3) on the risks and benefits from their use is scheduled to be issued shortly. Chlorothalonil has recently been re-evaluated through EPA's reregistration process. Risks from dietary exposure to this fungicide are estimated at 10^{-6} from chlorothalonil and 10^{-6} from the contaminant hexachlorobenzene (HCB), which has also been identified as a B_2 (probable human) oncogen. The risks from chlorothalonil do not meet the criteria for initiating a Special Review at this time. A draft Guidance For The Reregistration of Pesticide Products Containing Chlorothalonil was issued in September 1988.

The likely shifts in use patterns were assessed using information on which fungicides are registered for different use sites, and on EPA's assessment of the viability, in terms of efficacy and costs, of the remaining alternatives. EPA estimated the potential changes in risks from consumption of captan, EBDCs, or chlorothalonil residues if one or more of the three fungicides were cancelled. None of these cancellation scenarios caused a significant (i.e., greater than one-half an order of magnitude) increase in the overall estimated dietary risks posed by captan, chlorothalonil or the EBDCs. EPA undertook this assessment in order to determine whether the cancellation of all or some uses of these fungicides would result in unacceptable increases in risks.

3. *Benefits.* The benefits from food uses of captan are summarized in Unit IV. of this Notice. The majority of the comments received in response to EPA's PD 2/3 concerned the benefits of retaining captan for use on specific crops. Comments also addressed the problem of resistance to some of the alternative fungicides.

EPA has revised its benefits assessment as the result of these comments and other information received subsequent to the issuance of the captan PD 2/3. Benefits were assessed in terms of the economic impacts resulting from the cancellation of the use of captan and subsequent switching to alternative pest management practices. The effect of cancellation is expected to result in losses ranging from approximately $76.6 to $96.1 million dollars. These losses include $67.8 to $75.1 million in benefits from food uses and approximately $9 million from seed treatments. Losses to the ornamental industry could be as high as $12 million without the use of captan.

Other benefits are also recognized from the availability of captan although they are not quantifiable. Captan is important in preventing or delaying fungal resistance to other fungicides. For example, resistance problems with other fungicides would be expected to develop within 2 years on apples and cherries without the availability of captan.

C. Risk/Benefit Assessment: Specific

1. *Dietary Risk.* EPA has determined that the oncogenic risks resulting from dietary exposure to captan from all treated crops pose an unreasonable adverse effect and that these risks need to be reduced in order to ensure that the benefits of use outweigh the cumulative risks of use. The PD 2/3 for captan proposed cancellation of all food uses based on cumulative dietary risks

estimated to be in the 10^{-4} to 10^{-3} range. As discussed in Unit III of this Notice, EPA has calculated the dietary risks of captan in light of additional information obtained subsequent to the PD 2/3. The upper-bound oncogenic lifetime risk from dietary exposure to captan from all treated crops is estimated to be in the 10^{-6} to 10^{-5} range for the general population.

EPA considered two options for reducing these risks: cancellation of all food uses as proposed in the PD 2/3; and cancellation of some food uses to bring cumulative dietary risk from captan into balance with the benefits. In determining which food uses to cancel, EPA considered the benefits resulting from use on each individual commodity and compared those benefits to the risk posed from dietary exposure to residues of captan on the commodity. Recognizing the overall importance of captan as an agricultural fungicide in both the economic benefits it provides and the importance of its role in delaying or preventing resistance of fungal organisms to other pesticides, EPA examined ways of reducing risks to the point where the cumulative benefits from captan use outweighed its cumulative risks.

The individual dietary risk resulting from exposure to commodities containing captan residues ranges from 10^{-12} to 10^{-6}. Although many of the individual risks posed by certain food uses are very minimal, EPA believes the cumulative risk of 10^{-6} to 10^{-5} from all food uses to be unacceptable, even in light of benefits of $67.8 to $75.1 million.

The benefits of the use of captan on individual food commodities are discussed in detail in Unit IV of this Notice. In identifying the benefits of the uses of captan, EPA found that there were virtually no, or very minimal, benefits on a number of food commodities. The following Table 6 summarizes the dietary risks and benefits associated with each food crop.

TABLE 6—SUMMARY OF UPPER-BOUND LIFETIME ONCOGENIC RISKS AND BENEFITS FROM FOOD USES OF CAPTAN

Use	Risk	Estimated Benefits
1. Crops with substantial benefits:		
Almonds	10^{-11} to 10^{-10}	$1.7 million cost increase.
Apples	10^{-7}	Pre-harvest: $900,000 to $3.3 million losses. Post-harvest: $25 million losses.
Apricots	10^{-9} to 10^{-7}	$434,000 cost decrease to $700,000 cost increase.
Caneberries/blueberries		$3.5 to $4 million losses.
Blackberries	10^{-9}	
Blueberries	10^{-11}	
Dewberries	10^{-6} to 10^{-7}	
Raspberries	10^{-9}	
Celery	10^{-9}	$4.6 million losses.
Cherries	10^{-9}	$4.6 million losses.
Eggplant	10^{-11}	Plant-bed: no alternatives.
Grapes	10^{-8} to 10^{-7}	$1.2 million losses.
Lettuce	10^{-7}	$2.2 million losses.
Mangoes	10^{-9} to 10^{-7}	Slows Resistance/few alternatives.
Nectarines	10^{-10} to 10^{-9}	Up to $650,000 losses.
Onions, green	10^{-9}	Grefin: one alternative.
Peaches	10^{-7}	$2.3 to $6 million cost increase.
Pears	10^{-9}	Post-harvest: $18.3 million.
Peppers/pimentos	10^{-10}	Slows resistance/one alternative.
Plums/Prunes	10^{-9}	No/Few alternatives.
Spinach	10^{-8}	Plant-bed: few alternatives.
Strawberries	10^{-7}	$5.9 million cost increase.
Taro	10^{-13}	No alternatives.
Tomatoes	10^{-9}	Plant-bed: few alternatives.
2. Crops with minimal benefits: Avocado, beans, beets, broccoli, brussels sprouts, cabbage, carrots, cantaloupe/muskmelon, cauliflower, celery (foliar), collards, cotton, cranberries, cucumber, eggplant (foliar) grapefruit, honeydew, kale, lemons, limes, mustard greens, onions (dry bulb), oranges, pears (pre-harvest), peas, pineapple, potatoes, pumpkin, rhubarb, rutabaga, soybeans, squash, sweet corn, tangerines, tomatoes (foliar), watermelon.	10^{-12} to 10^{-5}	Minimal use; viable alternatives.
3. Crops with no indication of use:		
Crabapple, leeks, quince, shallots, turnips	10^{-11} to 11^{-9}	No indication of use; viable alternatives.
Total risk [1]	10^{-6} to 10^{-5}	
Total benefits		$67.8 to $75.1 million.

[1] Includes risk from captan residues in meat and milk.

In determining which food crops to retain, EPA first considered retention of all crops with any quantified or identifiable benefits presented an unreasonable risk. EPA calculated the cumulative risk from all 24 food uses which were identified as having such benefits. These are: Almonds, apples (pre- and post-harvest), apricots, blackberries, blueberries, celery (plant-bed), cherries (pre- and post-harvest), dewberries, eggplant (plant-bed), grapes, green onions, lettuce, mangoes, nectarines, peaches, pears (post-harvest only), plums/prunes, peppers (plant-bed), pimentos (plant-bed), raspberries, spinach (plant-bed), strawberries, taro and tomatoes (plant-bed).

The cumulative risk resulting from these uses poses an upper-bound lifetime oncogenic risk from dietary exposure to captan of 10^{-6} for the overall U.S. population. EPA believes this risk level is overstated, as discussed in Unit III, due to assumptions made regarding milk residues and the use of tolerance levels to calculate some food use risks. The cumulative economic benefits resulting from the use of captan on these commodities are estimated at $67.8 to $75.1 million. EPA believes the benefits are understated due to the unquantified value of captan in slowing or preventing the build-up of resistance to other pesticides and their utility in Integrated Pest Management (IPM) programs. EPA believes that the total quantified and unquantified benefits

from these 24 food uses outweigh the estimated risk.

The remaining uses (avocado, beans, beets, broccoli, Brussels sprouts, cabbage, carrots, cantaloupe/muskmelon, cauliflower, celery (foliar), collards, cotton, crabapple, cranberries, cucumber, eggplant (foliar), grapefruit, honeydew, kale, leeks, lemons, limes, mustard greens, onions (dry bulb), oranges, pears (pre-harvest), peas, pineapple, potatoes, pumpkin, rhubarb, rutabaga, shallots, soybeans, squash, sweet corn, tangerines, tomatoes (foliar), turnips, and watermelon) have no identifiable benefits. While none of these crops individually poses a risk of concern, collectively they result in an aggregate dietary risk from consumption of captan treated crops in the 10^{-6} range. Given that there are no offsetting benefits, EPA considers the risk from these uses to be unreasonable.

2. *Non-dietary.* EPA has also examined the risks posed from non-dietary exposure to captan. The PD 2/3 proposed certain precautionary measures in order to reduce non-dietary exposure and consequently risk. The Captan Registration Standard, and amendments to it, specified similar measures.

Many of the measures proposed in the PD 2/3 and specified in the Registration Standard contain precautionary information which should be followed when handling any pesticide. The following Table 7 shows the estimated risks to persons exposed to captan through various activities both without any particular protective clothing or measures and with the protective measures specified for captan previously in the Registration Standard.

TABLE 7.—SUMMARY OF NON-DIETARY RISKS

User	Risks (in PD 2/3) without protective measures	Risks with protective measures specified in Registration Standard
A. AGRICULTURAL USES		
1. Mixer/loaders:		
(a) Food uses	10^{-7} to 10^{-5}	10^{-8} to 10^{-6}.
(b) Ornamentals	10^{-6} to 10^{-3}	10^{-7} to 10^{-5}.
2. Applicators:		
(a) Food uses	10^{-7} to 10^{-5}	10^{-8} to 10^{-6}.
(b) Ornamentals	10^{-6} to 10^{-3}	10^{-7} to 10^{-5}.
3. Fieldworkers:		
(a) Food uses	10^{-6} to 10^{-4}	(2)
(b) Ornamentals	10^{-6} to 10^{-3}	(2)
4. Cut flower industry:		
(a) Mixer/loader/sprayer:		
(i) Dermal	10^{-7}	10^{-7}.
(ii) Inhalation	10^{-7}	10^{-7}.
(b) Cutting/packaging:		
(i) Dermal	10^{-7} to 10^{-5}	(2)
(ii) Inhalation	Negligible	(2)
5. Home garden uses [3]	10^{-7}	10^{-7}.
B. NON-AGRICULTURAL USES		
1. Industrial mixer/loader/applicator incorporating captan into:		
(a) Adhesives	Negligible [4]	(2)
(b) Paints/plastics/cosmetics	Negligible	(2)
2. End uses:		
(a) Adhesives:		
(i) Home uses	10^{-7} to 10^{-5}	10^{-8} to 10^{-7}.
(ii) Professional	10^{-5}	10^{-6}.
(b) Aerosol sprays	10^{-5}	(2)
(c) Mattresses/pillows	10^{-6} to 10^{-5}	(2)
(d) Packing boxes	Negligible	(2)
(e) Paints:		
(i) Oil-based	10^{-5}	(2)
(ii) Water-based	10^{-6}	(2)
(f) Pet products:		
(i) Pet powders	10^{-3} to 4	(2)
(ii) Pet shampoos	10^{-5} to 10^{-4}	No longer registered.
(g) Plastics	Negligible	(2)
(h) Powdered-hand soap	10^{-5} to 10^{-3}	(2)

[1] EPA will reevaluate estimated risks from exposure to field workers and harvesters and reentry schedules when additional data, required in the Registration Standard under § 158.140 Subdivision K, Reentry, have been received and reviewed.

[2] No additional protective clothing requirements imposed.

[3] The estimate of risks from exposure to home garden uses assumes that a short-sleeved shirt and long-legged pants are worn (Kurtz and Boda, 1985). EPA requires that product labels include protective measures for home uses but estimates risks for these uses on a worst-case basis.

[4] The risk estimates presented in the PD 2/3 were incorrect; correct risk estimates appear in this table.

a. *Protective clothing requirements for mixers/loaders and applicators.* In the PD 2/3, the risks to mixers/loaders and applicators for agricultural food and non-food uses was estimated to be 10^{-7} to 10^{-5} and 10^{-6} to 10^{-3}, respectively. The PD 2/3 proposed protective measures for agricultural non-food uses but did not for agricultural food uses since cancellation of these uses was proposed due to the dietary risk concerns. However, protective measures for mixers/loaders and applicators for agricultural food uses were specified in the Captan Registration Standard pending EPA's Final Determination. EPA estimates that the resulting risks from implementation of these protective measures are 10^{-8} to 10^{-6} for agricultural food uses and 10^{-7} to 10^{-5} for agricultural non-food uses.

The risk to persons applying captan to home gardens, yards, and/or house plants was estimated in the PD 2/3 to be 10^{-7}. These estimates assume that a short-sleeved shirt and long pants are worn. The protective measures,

including the use of chemical resistant gloves, specified in the Registration Standard and amendments would reduce exposure to these home uses of captan. However, no risk reduction is assumed in Table 7 since EPA assumed a worst case situation where these measures will not be adhered to.

The estimated risks from exposure to oil-base paint end-use products containing captan were estimated, in the PD 2/3, to be 10^{-5} for commercial applicators. The PD 2/3 proposed a requirement that persons applying oil-base paint wear chemical resistant gloves. This requirement was not included in the Registration Standard or in this Final Determination since EPA believes risks without gloves are marginally acceptable and that a requirement to wear gloves is not likely to be adhered to.

The risks to mixers/loaders and applicators applying or incorporating captan into adhesives, cosmetics, paints, and plastics was estimated to be negligible in the PD 2/3 for all uses except adhesives which was estimated to be 10^{-6}. The negligible risks for persons incorporating captan in cosmetics, paints, and plastics assumed that protective clothing, as proposed in the PD 2/3, is normally worn. The PD 2/3 estimate for adhesives should have similarly assumed that protective clothing is normally worn by mixers/loaders and applicators. Given that these protective clothing measures for mixers/loaders and applicators are already used under good industrial practices and that resulting risks are low to negligible, EPA did not specify any protective measures on these uses in the Registration Standard and is not doing so in this Final Determination.

EPA has concluded that although the risks posed to mixers/loaders and applicators are not unreasonable given the benefits of use, the protective clothing requirements would not reduce the benefits of use, are inexpensive and easily obtained, and are generally followed by persons using good agricultural and industrial practices in handling pesticides in order to reduce unnecessary exposure. These measures were specified in the Registration Standard, and most registrants have already modified their labels to comply with them. No additional action is being taken under this Final Determination.

b. *Fieldworker/harvester requirements.* Limited data available to EPA at this time indicate that there is significant dermal exposure to persons working in fields treated with captan. The PD 2/3 estimated risks to range from 10^{-6} to 10^{-4}. Additionally, significant dermal exposure can result to persons entering fields treated within 4 days if adequate protective clothing is not worn. EPA is currently evaluating data recently received which will allow a better assessment of exposure resulting to fieldworkers and harvesters.

Depending on the results of this final assessment, further regulatory action may be necessary. The protective clothing requirements specified in the Registration Standard are expected to reduce risks to 10^{-5} to 10^{-7}.

3. *Conclusions*—a. *Dietary risk.* The cumulative upperbound lifetime risk for all food uses with quantifiable or identifiable benefits is 10^{-4}. EPA believes that the significant benefits from the use of this pesticide on these crops ($67.8 to $75.1 million) outweighs this level of risk, given that this risk estimate is conservative and that some significant benefits are unquantifiable. The remaining registered food uses collectively push the cumulative dietary risk from all treated crops to the 10^{-6} to 10^{-5} level. Given that these uses result in a higher cumulative risk and contribute no offsetting benefits, EPA concludes that these uses of captan constitute an unreasonable risk.

b. *Non-dietary risk.* A number of risk reduction measures (protective clothing requirements) were identified in the PD 2/3 to reduce risks to mixers, loaders, applicators, fieldworkers, and harvesters. These requirements were subsequently specified in the Registration Standard and most registrants have amended their labels to comply with these requirements. These requirements conform with good practice and present minor, if any, cost to growers. Because these risks are not unreasonable even in the absence of protective clothing, EPA is not imposing these requirements in this Final Determination. However, EPA believes the measures constitute good practice and reduce risks and should be adhered to.

D. Cancellation of Certain Uses

Based on the information summarized and discussed elsewhere in this Notice, EPA has determined that certain uses of captan as currently registered pose unreasonable dietary risk. Therefore, all products that bear uses on food must limit use to the following:

(a) Plant-bed treatments of captan on celery, eggplant, peppers, pimentos, spinach and tomatoes.

(b) Pre-harvest uses of captan on almonds, apples, apricots, blackberries, blueberries, cherries, dewberries, grapes, green onions, lettuce, mangoes, nectarines, peaches, plums/prunes, raspberries, strawberries and taro.

(c) Post-harvest uses of captan on apples, cherries and pears.

(d) Seed treatment uses of captan.

E. Tolerance Reductions/Revocations

As a result of the actions required by this Notice and in response to additional residue data submitted in support of the continued registration of captan on certain food commodities, EPA will be proposing to reduce or revoke tolerances for a number of food commodities. Reductions in tolerance levels will be proposed within the next 6 months for the following raw agricultural commodities: apricots, cherries, nectarines, peaches, plums (fresh prunes), and tomatoes. These reductions reflect lower residues from currently labelled application rates, as evidenced in the recently submitted field trial residue studies.

Additionally, EPA will propose that tolerances on many of the following raw agricultural commodities be revoked since the accompanying registrations on uses (other than seed treatments) are being cancelled: avocados, beans (dry and succulent), beets, broccoli, Brussels sprouts, cabbage, cantaloupe, carrots, cauliflower, collards, cotton seed, crabapples, cranberries, cucumbers, garlic, grapefruit, kale, leeks, lemons, limes, muskmelon, mustard greens, onions (dry bulb), oranges, peas, pineapple, potatoes, pumpkins, quince, rhubarb, rutabaga (roots), shallots, soybeans (dry and succulent), squash (summer and winter), sweet corn, tangerine/tangelos, turnips (roots and greens), and watermelon.

As discussed previously, EPA will also be proposing to revoke the tolerance for residues of captan on detreated corn seed. For many of these crops, registrations also include use on seed. Seed treatment registrations are not affected by this regulatory decision. Residue data reflecting the use of captan resulting from seed treatments are not due to be submitted until July, 1989. At that time, some of these tolerances may be reduced rather than revoked to reflect continuing use as seed treatments. EPA intends to review the data submitted in July, reach a regulatory decision on appropriate tolerance levels, and propose these tolerance revocation or reduction actions prior to the end of the year.

F. Provisions Governing Sale and Use of Nonconforming Stocks

This section sets forth requirements concerning stocks of captan products subject to this Notice that do not bear an approved amended label conforming to the requirements of Unit VI.D. of this

Notice. Specifically, captan products that bear food uses must limit the food uses to the following:

(a) Plant-bed treatments of captan on celery, eggplant, peppers, pimentos, spinach and tomatoes.

(b) Pre-harvest uses of captan on almonds, apples, apricots, blackberries, blueberries, cherries, dewberries, grapes, green onions, lettuce, mangoes, nectarines, peaches, plums/prunes, raspberries, strawberries and taro.

(c) Post-harvest uses of captan on apples, cherries and pears.

(d) Seed treatment uses of captan. Non-food uses of captan are not affected by this Notice. These requirements will apply to all nonconforming stocks including existing stocks of products that are cancelled pursuant to this Notice and to stocks of products that amend their registrations pursuant to the requirements of this Notice. In both cases, this Notice requires that nonconforming stocks be relabeled according to specified time frames, and it prohibits use of all captan products for certain food uses after 1 year from the date of publication of this Notice in the Federal Register.

For purposes of this Notice, existing stocks are defined as any quantity of captan product subject to this Notice that has been formulated, packaged, and labeled for use prior to the date by which the registration of the product is cancelled pursuant to this Notice. Pursuant to FIFRA section 6(a)(1), the Administrator may permit the continued sale and use of existing stocks of a pesticide whose registration (is cancelled pursuant to this Notice) to such extent, under such conditions, and for such cases as he may specify, if he determines that such sale or use is not inconsistent with the purposes of (FIFRA) and will not have unreasonable adverse effects on the environment. EPA has determined that limited sale and use of certain existing stocks of captan is not inconsistent with the purposes of FIFRA and will not cause unreasonable adverse effects on the environment. This determination was made after weighing the incremental increase in risks resulting from 1 additional year of exposure when captan is not used in accordance with the requirements of this Notice against the incremental benefits of such use and the costs associated with relabeling or disposal. Accordingly, under the authority of FIFRA section 6(a)(1), EPA will permit the continued sale and use of existing stocks of captan products for 1 year from the date of publication of this Notice, provided that such sale and use is otherwise consistent with the previously approved labeling of the product and subject to the following conditions and limitations:

Two months from the date of publication of this Notice, registrants must affix revised labeling to existing stocks in their possession. Such revised labeling must indicate that the product may not be sold after the date which is 1 year after the date of publication of this Notice, and may be used after that date only on the food uses identified above.

After 2 months from the date of publication of this Notice, registrants may not sell or distribute existing stocks unless those stocks bear this revised labeling.

Registrants are required to contact their distributors of captan products within 6 months of the date of publication of this Notice and inform the distributors of the time limitations being placed on sale and use of captan existing stocks. Registrants must also provide distributors with revised labeling indicating that existing stocks may not be sold after 1 year after the date of publication of this Notice, and may be used after that date only on the food uses identified above.

After 6 months from the date of publication of this Notice, no person may sell or distribute existing stocks unless those stocks bear revised labeling.

After 1 year from the date of publication of this Notice, it will be unlawful to use existing stocks of captan except for the food uses identified above.

Similar limitations apply to stocks of captan products whose registrations are amended pursuant to the terms of this Notice. As a condition of the amended registration, registrants must affix an approved label modified in accordance with the requirements of this Notice to all end use products released for shipment 1 year after the date of publication of this Notice. Further, as a condition of the amended registration, products not bearing this approved label (i.e., products released for shipment prior to adoption of the approved label) may only be sold and used subject to the following conditions and limitations:

Two months from the date of publication of this Notice, registrants must affix revised labeling to stocks in their possession not bearing approved labeling. Such revised labeling must indicate that the product may not be sold after the date 1 year after publication of this Notice, and may be used after that date only on the food uses identified above.

After 2 months from the date of publication of this Notice, registrants may not sell or distribute stocks not bearing approved labeling unless those stocks bear this revised labeling.

Registrants are required to contact their distributors of captan products within 6 months of the date of publication of this Notice and inform the distributors of the time limitations being placed on sale and use of captan stocks not bearing approved labeling. Registrants must also provide distributors with revised labeling indicating that stocks not bearing approved labeling may not be sold after 1 year after the date of publication of this Notice, and may be used after that date only on the food uses identified above.

After 6 months from the date of publication of this Notice, no person may sell or distribute stocks not bearing approved labeling unless those stocks bear revised labeling. After 1 year from the date of publication of this Notice, it will be unlawful to use stocks of captan not bearing approved labeling except for the food uses identified above.

Any disposal of nonconforming stocks must be in accordance with the requirements of all applicable Federal, State, and local laws, including the Resource Conservation and Recovery Act.

VII. Procedural Matters

This Notice announces EPA's final decision to cancel all registrations and to deny all applications for registration of products containing captan which do not comply with the modified terms and conditions of registration set forth in this Notice. This action is being taken pursuant to authority granted by section 6(b) of FIFRA. Under FIFRA sections 6(b)(1) and 3(c)(6), applicants, registrants and certain other adversely affected parties may request a hearing on the cancellation or denial actions that this Notice initiates. Any hearing concerning cancellation or denial of registration for any pesticide product containing captan will be held in accordance with FIFRA section 6(d). Alternatively, registrants/applicants may apply to amend the product registrations/applications to remove the uses cancelled by this Notice within 30 days of publication of this Notice. Unless a hearing or amended registration is properly requested with regard to a particular registration or application, the registration will be cancelled or the application denied. This Unit of the Notice explains how such persons may request a hearing or amend their registrations in accordance with the procedures specified in this Notice, and the consequences of requesting or

failing to request a hearing or submit an amended registration or application.

A. Procedures for Requesting a Hearing

To contest the regulatory action initiated by this Notice, registrants, or any applicant for registration whose application for registration is affected by this Notice (including intrastate applicants who have previously marketed such products pursuant to 40 CFR 162.17), may request a hearing within 30 days of receipt of this Notice, or within 30 days from the date of publication of this Notice in the Federal Register, whichever occurs later. Any other persons adversely affected by the cancellation action described in this Notice, or any interested persons with the concurrence of an applicant whose application for registration has been denied, may request a hearing within 30 days of publication of this Notice in the Federal Register.

All registrants, applicants and other adversely affected persons who request a hearing must file the request in accordance with the procedures established by FIFRA and EPA's Rules of Practice Governing Hearings (40 CFR Part 164). These procedures require that all requests must identify the specific registration(s) by Registration Number(s) and the specific use(s) for which a hearing is requested and must be received by the Hearing Clerk within the applicable 30-day period. Failure to comply with these requirements will result in denial of the request for a hearing. Requests for a hearing should also be accompanied by objections that are specific for each use of the pesticide product for which a hearing is requested.

Requests for a hearing must be submitted to: Hearing Clerk (A-110), Environmental Protection Agency, 401 M St., SW., Washington, DC 20460.

1. *Consequences of filing a timely and effective hearing request.* If a hearing on any action initiated by this Notice is requested in a timely and effective manner, the hearing will be governed by EPA's Rules of Practice Governing Hearings under FIFRA section 6 (40 CFR Part 164). All hearings will be held in Washington, DC. In the event of a hearing, each cancellation action concerning the specific use or uses of the specific registered product which is the subject of the hearing will not become effective except pursuant to an order of the Administrator at the conclusion of the hearing.

The hearing will be limited to the specific registrations or applications for which the hearing is requested.

2. *Consequences of failure to file in a timely and effective manner.* If a hearing concerning the cancellation or denial of registration of a specific captan product subject to this Notice is not requested in a timely and effective manner by the end of the applicable 30-day period, registration of that product will be cancelled or the denial will be effective.

B. Amendment of Registration or Application

Registrants of captan products who are affected by this Notice of Intent to Cancel (NOIC) may avoid cancellation of their registrations without requesting a hearing by filing an application for an amended registration to amend product labeling to comply with the labeling requirements described in Unit VI. of this NOIC. Applications containing the label modifications required by this Notice must include 3 copies of the revised label. The approved label must be affixed to all end use products released for shipment 1 year after publication of this Notice. All registrations or applications for registration must be filed within 30 days of receipt of this Notice, or within 30 days of the date of publication of the final notice whichever occurs later. Similarly applicants for a registration that is subject to this NOIC must file an amended application for registration within the applicable 30-day period to avoid denial of the application. The failure to file an amendment on time or the timely filing of an inadequate amendment will result in automatic cancellation pursuant to FIFRA section 6(b).

Registrants whose registrations become cancelled but who wish to use the existing stocks provisions provided above must submit revised labeling, including time limitations on use, for EPA acceptance prior to the sale and distribution of such existing stocks. All applications must be addressed to: Eugene Wilson, Assistant Product Manager Number 21, Registration Division (TS-767C), Office of Pesticide Programs, Environmental Protection Agency, 401 M St., SW., Washington, DC 20460.

C. Separation of Functions

EPA's rules of practice forbid anyone who may take part in deciding this case, at any stage of the proceeding, from discussing the merits of the proceeding ex parte with any party or with any person who has been connected with the preparation or presentation of the proceeding as an advocate or in any investigative or expert capacity, or with any of his/her representatives (40 CFR 164.7).

Accordingly, the following EPA offices, and the staffs thereof, are designated as the judicial staff of EPA in any administrative hearing on this Notice of Intent to Cancel: The Office of Administrative Law Judge, the Office of the Judicial Officer, the Deputy Administrator and the members of the staff in the immediate office of the Deputy Administrator, the Administrator and the members of the staff in the immediate office of the Administrator. None of the persons designated as the judicial staff may have any ex parte communications with the trial staff or any other interested person not employed by EPA on the merits of any of the issues involved in these proceedings, without fully complying with the applicable regulations.

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All but the published references concerning this Final Determination on Captan are available for inspection from 8 a.m. to 4 p.m., Monday through Friday, except legal holidays in the Public Docket and Freedom of Information Section, Field Operations Division (TS-767C), Office of Pesticide Programs, Environmental Protection Agency, Room 240, Crystal Mall #2, 1921 Jefferson Davis Highway, Arlington, VA 22202. Telephone: 703/557-2805.

Dated: February 16, 1989.

John A. Moore,

Acting Administrator.

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